# FINAL REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

### Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by


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# Acronyms

| | |
|---|---|
| Anchor QEA | Anchor QEA, LLC |
| AOC | Administrative Settlement Agreement and Order on Consent |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| Aspect | Aspect Consulting, LLC |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| COI | chemicals of interest |
| cPAH | carcinogenic polycyclic aromatic hydrocarbon |
| DGPS | differential global positioning system |
| DNR | Washington Department of Natural Resources |
| Ecology | Washington Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| EPC | exposure point concentrations |
| FID | Flame Ionization Detector |
| FSP | Field Sampling Plan |
| Gas Works | Former Bremerton gas works facility |
| GIS | geographic information system |
| HHRA | Human Health Risk Assessment |
| HPAH | high molecular weight PAH |
| IDW | inverse distance weighting |
| KCHD | Kitsap County Health District |
| LDW | Lower Duwamish Waterway |
| LPAH | low molecular weight PAH |
| mg/kg | milligrams per kilogram |
| MLLW | mean lower low water |
| NPL | National Priorities List |
| OC | organic carbon |
| Order | Administrative Order for a Pollution Incident |

| | |
|---|---|
| PAH | polycyclic aromatic hydrocarbons |
| PID | Photoionization Detector |
| Pipe | 12-inch concrete pipe |
| QAPP | Quality Assurance Project Plan |
| RBTC | risk-based threshold concentration |
| RI/FS | Remedial Investigation/Feasibility Study |
| RME | reasonable maximum exposure |
| SMS | Sediment Management Standards |
| SWAC | surface-weighted average concentration |
| TCRA | Time Critical Removal Action |
| TEF | toxicity equivalency factor |
| TOC | total organic carbon |
| UCL | upper confidence limit |
| USCG | U.S. Coast Guard |
| Work Plan | Removal Evaluation Work Plan |

# 1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gas Works Site (Site) in Bremerton, Washington. Prior to completion of the RI/FS, a removal evaluation is required to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrant performance of an additional removal action. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013. Figure 1 shows the location of the former Bremerton gas works facility (Gas Works), and Section 2 provides a summary of Site history and background.

## 1.1 Purpose and Objectives

Submittal of this Removal Evaluation Work Plan (Work Plan) is the first task under the AOC. This Work Plan includes a detailed Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The Work Plan presents detailed descriptions of the data collection tasks to be performed to complete the removal evaluation.

The sampling and analysis activities to be performed are intended to meet the following data quality objectives:

- Collect the information necessary to evaluate whether current surface sediment contamination within the intertidal beach area adjacent to the former Gas Works poses an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC, as follows:
    - Samples will be collected in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line.
    - The depth of sampling will be surface composites in the 0 to 10 cm (0 to 4 inch) depth interval.
    - Samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC).
    - These data will be used to estimate potential Site-related risks to beach users (evaluated using a recreational beach use scenario) and to benthic ecological receptors.
- Inspect the former drainage and piping system connected to the 12-inch pipe addressed during the November 2010 Time Critical Removal Action (TCRA) by evaluating potential influent sources to a manhole (Manhole "A") believed to be connected to the pipe that was plugged. This information will be used to identify potential ongoing or threatened contaminant migration pathways to the beach.

- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of sheen, product, hydrocarbon odor, or photoionization detector or flame ionization detector (PID/FID) readings, soil samples will be collected and archived for potential analysis of PAHs and TOC.

Data generated as part of the removal evaluation will be summarized in a Removal Evaluation Report to be prepared following completion of sampling, analysis, and data validation. All work will be performed in accordance with the project schedule as defined in Section 7.

## 1.2 Document Organization

This Work Plan was prepared in accordance with the following EPA requirements and guidance:

- EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, Final, March 2001 (EPA 2001a).
- EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans, December 2002 (EPA 2002c).
- EPA QA/G-4, EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006 (EPA 2006).

This Work Plan is organized as follows:

- **Section 2: Site Background.** This section provides a summary of the Site history, historical environmental investigations, and the 2010 TCRA.
- **Section 3: Focus of Removal Evaluation.** This section describes the focus of the removal evaluation, which has been developed based on current and historical Site conditions and the requirements of the AOC. This section also identifies the contaminants of interest (COIs), and provides a summary of how detected concentrations of COIs will be screened to evaluate potential impacts to human health and ecological receptors.
- **Section 4: Sampling of Intertidal Beach Area.** This section details the sampling and analysis rationale and methods to characterize surface sediment contamination at the beach from the high tide line to MLLW and to evaluate whether PAH concentrations pose an imminent and substantial threat to public health or the environment.
- **Section 5: Inspection of Former Drainage and Piping System**. This section details the rationale and methods to investigate the drainage and piping system connected to the 12-inch pipe addressed by the 2010 TCRA.
- **Section 6: Bluff Inspection and Contingent Sampling**. This section summarizes work to be performed to inspect the base of the bluff along Port Washington Narrows for potential hydrocarbon seeps.

- **Section 7: Project Reporting and Schedule.** This section describes how information will be communicated and data managed, and summarizes the current removal evaluation schedule.
- **Appendix A:** Field Sampling Plan.
- **Appendix B:** Quality Assurance Project Plan.
- **Appendix C**: Record Drawings of Former Drainage and Piping System Addressed by November 2010 Time Critical Removal Action.
- **Appendix D**: Risk Screening Input Parameters for Recreational Beach User Scenario.

# 2 Site Background

This section provides background information regarding the Site. Consistent with the AOC, the Site includes the area where the Gas Works was formerly located (Figure 1) and areas suspected/anticipated to be affected by contamination originating from the former Gas Works.

## 2.1 Site History

The Gas Works was formerly located on approximately 2.8 acres of property along the south shore of Port Washington Narrows in Bremerton, Washington, between Thompson and Pennsylvania Avenues (Figure 1). As shown in Figure 2, the Gas Works was located on portions of properties that are currently owned by the McConkey Family Trust (McConkey, Paul and Margaret Trustees) (McConkey Property) and Natacha Sesko (Sesko Property). A dock associated with Gas Works operations was located within Port Washington Narrows as shown in Figure 2.

The Gas Works produced gas for lighting and heating through manufactured gas plant operations from approximately 1930 to the mid-1950s and through blending of propane and air from the mid-1950s to 1963. The Gas Works structures were removed between 1963 and the early 1970s.

After the Gas Works properties were sold, the McConkey Property and the Sesko Property were used for industrial purposes, including metal fabrication, concrete forming, and boat repair. The Sesko Property has also been used for the storage of miscellaneous equipment and debris. The Sesko Property and the majority of the McConkey Property are currently vacant. The following three petroleum storage and distribution facilities were formerly or are currently present in the immediate vicinity of the former Gas Works:

- A bulk petroleum facility operated on a portion of the Sesko Property between the early to mid-1940s and approximately 1993.
- A former ARCO bulk petroleum facility operated on property located to the southwest of the former Gas Works between approximately 1942 and 1992; this property is currently owned and operated by Pipeworks Mechanical & Service, Inc.
- A bulk petroleum facility currently operated by SC Fuels is located to the east of the Sesko Property, across Pennsylvania Avenue. A bulk petroleum terminal has operated in that location since the early to mid-1940s.

Historically, petroleum products were delivered to all three fuel facilities by barge. Three separate docks were used for product delivery over the years. Use of the docks was consolidated over time, and two or more of the fuel facilities shared a single dock in later years. Figure 2 shows the locations of the three historical fuel docks as well as the former Gas Works dock.

## 2.2 Historical Environmental Investigations

The former Gas Works, the bulk fuel facilities, and other former and current operations in the vicinity of the Site have been the subject of multiple environmental studies. A list of studies focused primarily on the former Gas Works has been provided to EPA for their files and includes:

- Inspection Field Notes and Lab Report from initial investigation inspection (Ecology 1995).
- Targeted Brownfields Assessment Report, Old Bremerton Gas Works – McConkey Properties (Techlaw 2006).
- Preliminary Upland Assessment Report, McConkey/Sesko Brownfields Site (GeoEngineers 2007).
- Historical Characterization and Data Gaps, Old Bremerton Gas Works Property 1725 Pennsylvania Avenue (Hart Crowser 2007).
- Final Bremerton Gas Works Targeted Brownfields Assessment Report (Ecology and Environment 2009).

A detailed review of historical environmental investigations will be performed to determine the usability of these data for the RI/FS and risk assessment. The results of this review will be presented in the RI/FS Work Plan.

## 2.3 2010 Time Critical Removal Action

On August 20, 2010, the Kitsap County Health District (KCHD) observed intermittent sheens on surface water of Port Washington Narrows near the former Gas Works. Further investigation by KCHD on October 4, 2010, identified a 12-inch concrete pipe (Pipe) buried beneath the intertidal beach sediments that appeared to be discharging hydrocarbon product to marine waters. KCHD reported the finding to EPA. EPA relayed the finding to the U.S. Coast Guard (USCG) on October 5, 2010, because the Pipe was within USCG's area of responsibility (EPA 2010).

USCG mobilized to the Site on October 6, 2010. USCG took immediate action to contain the hydrocarbon sheen by installing a containment system as of October 10, 2010, and conducting frequent monitoring of Site conditions. On October 16, 2010, USCG commenced activities to mitigate the apparent discharge from the Pipe. The activities included breaking of a 4-foot section of the Pipe with a hydraulic hammer, plugging the Pipe-end in that area, and placing hydraulic cement over the temporary plug. These activities were implemented by an emergency response contractor working at the direction of USCG.

EPA, in coordination with USCG and in conjunction with the response activities, collected surface sediment samples for analysis of PAHs. Samples collected by EPA as part of this effort are shown on Figure 4 (that figure also shows the locations of previous sediment samples collected in August 2009 by Ecology and Environment as part of the Targeted Brownfields Assessment). The Washington State Department of Ecology (Ecology) analyzed a sample of material collected near the Pipe by KCHD on September

24, 2010, only for hydrocarbon identification by HC-ID (Appendix B). The sample was characterized by the laboratory as a "coal-tar creosote" type of product.

EPA collected a sample of material from inside the Pipe on October 5, 2010, and analyzed it for PAHs.

The USCG established a Unified Command to assist with the response activities. The Unified Command initially included representatives of USCG, EPA, Ecology, Washington Department of Natural Resources (DNR), and KCHD.

On October 18, 2010, Cascade first learned of the response activities at the Site and contacted EPA that same day expressing an interest in being involved in the response. On October 19, 2010, Cascade met with USCG, EPA, and the rest of the Unified Command to discuss additional actions appropriate at the Site. The USCG subsequently added Cascade to the Unified Command and issued Cascade an Administrative Order for a Pollution Incident (Order) to implement response actions at the Site under oversight of USCG. Cascade accepted the Order (Acceptance of Order) in a letter dated October 29, 2010.

Under EPA and USCG oversight, Cascade implemented a TCRA including completion of the following activities:

- Investigation of the location and orientation of the abandoned Pipe.
- Permanent plugging of the Pipe as close as practicable to the shoreline.
- Removal of all portions of the Pipe from the new plug to the terminus of the Pipe.
- Backfilling of the excavation created by removal of the Pipe with clean beach material.
- Placement of an Organo-Clay mat over impacted sediments near the terminus of the Pipe that had been observed to generate sheen with only minimal disturbance.
- Continued maintenance of a containment system and field observations and inspections to confirm the situation remains stable (no sheen).

The TCRA was successfully completed between November 5 and November 8, 2010. The results of the removal action were documented in a Completion Report (Anchor QEA 2011).

Post-completion inspections of the removal action area have been performed on behalf of Cascade between 2010 and 2013. These inspections have been conducted pursuant to the TCRA Work Plan (Anchor QEA and Aspect 2010). Results of monitoring have shown that the removal action has contained the hydrocarbon sheen, and the temporary cap has been colonized by surface algae.

## 2.4 NPL Listing and AOC Development

EPA placed the Site on the National Priorities List (NPL) on May 10, 2012. EPA and Cascade subsequently negotiated an AOC for performance of a RI/FS at the Site. The AOC was executed on May 1, 2013.

As required by the AOC, a removal evaluation will be performed prior to initiation of the RI/FS. The removal evaluation is intended to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrants performance of an additional removal action before completion of the RI/FS and selection of a final remedy. This Work Plan outlines the sampling activities to be performed to support the removal evaluation.

# 3 Focus of Removal Evaluation

This Section describes the focus areas for the removal evaluation, including potential migration pathways and COIs. This analysis is based on the history of the Site and the requirements of the AOC.

## 3.1 Potential Contaminant Migration Pathways to Washington Narrows

Consistent with the AOC, the focus of the removal evaluation is on potential releases or threatened releases of contamination at the Site, in particular potential releases from the Site to the sediments and water of Port Washington Narrows. Such releases could potentially occur via three pathways:

- Residual Contamination in Intertidal Beach Sediments: The 2010 TCRA addressed areas of hydrocarbon impacts in surface sediments within a portion of the intertidal beach area. Visual monitoring since November 2010 has indicated that the TCRA has successfully contained areas of intertidal sediments with hydrocarbon sheen. Chemical sampling will be performed to document current PAH concentrations in surface sediments. This sampling will be used to assess whether contaminant concentrations present an imminent and substantial risk to human health or the environment. Data interpretation will include estimation of potential Site-related risks to beach users (evaluated using a recreational beach user scenario that includes early childhood exposure) and to benthic ecological receptors. These results will be used to determine if additional removal actions are required prior to initiation of the RI/FS. This work is described in Section 4 of this Work Plan.
- Migration via Former Drainage and Piping System: The 2010 TCRA included excavation and plugging of the Pipe, which was located within the intertidal beach area. The Pipe may be connected to a manhole (identified in record drawings as Manhole “A”; Appendix C) located on the McConkey Property. This manhole will be inspected to determine if further measures are required to remove or mitigate contaminants or their migration pathways between the upland area of the Site and Port Washington Narrows before completion of the RI/FS. A description of the former drainage and piping system and the proposed inspection program is described in Section 5 of this Work Plan.
- Potential Hydrocarbon Migration along the Bluff: The upland area of the Site slopes steeply down to the beach. To date, no areas of hydrocarbon sheen or seepage have been noted along the bluff/beach line. This area will be further inspected as part of the removal evaluation to determine if additional actions are warranted to remove or mitigate contaminants or their migration pathways between the upland area of the Site and Port Washington Narrows before completion of the RI/FS. This work is described in Section 6 of this Work Plan.

## 3.2 Contaminants of Interest for the Removal Evaluation

The COIs for the removal evaluation were identified by EPA in the AOC based on their identified presence in the intertidal sediments during the 2010 TCRA. These compounds can be associated with Gas Works operations, but also with petroleum hydrocarbons, treated wood pilings, combustion byproducts, and stormwater. The following PAH compounds will be included in the chemical analysis performed during the removal evaluation:

- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benz(a)anthracene*
- Benzo(a)pyrene*
- Benzo(b)fluoranthene*
- Benzo(g,h,i)perylene
- Benzo(j)fluoranthene*
- Benzo(k)fluoranthene*
- Chrysene*
- Dibenzo[a,h]anthracene*
- Dibenzofuran
- Fluoranthene
- Fluorene
- Indeno(1,2,3-c,d)pyrene*
- Naphthalene
- Phenanthrene
- Pyrene

Carcinogenic PAHs (cPAHs) are noted with an asterisk.

For the purpose of calculating indicator chemical sums, one-half the detection limit will be applied if an individual compound in the total is undetected. If all compounds in the total are undetected, the maximum detection limit will be applied and the result will be flagged with a “U” qualifier.

Calculation of cPAH totals will be performed as part of the health screening task during the removal evaluation. The total cPAH concentration is expressed as a benzo(a)pyrene toxicity equivalency quotient (TEQ). The total cPAH concentration is computed with individual cPAHs weighted according to their benzo(a)pyrene toxicity equivalency factor (TEF; EPA 1993). As an additional point of comparison, the TEFs promulgated under the current MTCA rule (2007) will be applied to calculate cPAH TEQ values used in exposure estimates. The MTCA cPAH TEQ values will be calculated because they represent a more current evaluation of cPAH potency and because MTCA is an applicable or relevant and appropriate requirement (ARAR) under CERCLA.

| Carcinogenic PAH | TEF (Unitless) |
|---|---|
| Benzo(a)pyrene | 1 |
| Benzo(a)anthracene | 0.1 |
| Benzo(b)fluoranthene | 0.1 |
| Benzo(k)fluoranthene | 0.01 |
| Chrysene | 0.001 |
| Dibenz(a,h)anthracene | 1 |
| Indeno(1,2,3cd)pyrene | 0.1 |

As described below in Section 4.4, the ecological receptor in direct contact with sediment that will be used to develop screening levels is the benthic invertebrate community. The Washington State Sediment Management Standards (SMS) provide sediment quality standards for the protection of benthic invertebrates for two PAH indicator chemical groups, low molecular weight PAHs (LPAH) and high molecular weight PAHs (HPAH). Total LPAH is calculated as the sum of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. Total HPAH is calculated as the sum of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

# 4 Sampling of Intertidal Beach Area

This section addresses the sampling and analysis work to be performed within the intertidal beach sediments adjacent to the former Gas Works. Data needs, sampling strategy, and proposed data interpretation steps are described consistent with AOC requirements and EPA expectations defined in project meetings and teleconferences.

## 4.1 Data Needs

Despite the presence of previous sampling data (see Figure 2), additional sample collection and analysis is required to define current contaminant concentrations within the intertidal beach sediments. The previously collected data are not adequate for this purpose given the following limitations:

- Data quality: Some of the existing data have QA/QC limitations, including missing QA/QC documentation and/or elevated detection limits. These limitations prevent use of these data for removal evaluation decision-making.
- Inconsistent coverage: Previous sampling efforts were biased toward the 2010 TCRA area. Data coverage in other beach areas is insufficient to complete the removal evaluation.
- Changes following the removal evaluation: The previous sampling data were collected prior to the implementation of the 2010 TCRA. This data may not be representative of current conditions due to the beneficial impacts of the TCRA.

Current sediment sampling data are required to address the following information needs:

- Characterize current PAH concentrations within the intertidal beach sediments adjacent to the former Gas Works.
- Determine whether current exposure conditions at the Site pose an imminent and substantial threat to human health or the environment that requires a removal action before completion of the RI/FS.

## 4.2 Sampling and Analysis Approach

Sediment sampling within the intertidal beach areas will include collection and analysis of 30 surface sediment samples from the locations shown in Figure 4.

Each sample will be collected at low tide using hand tools. Surface samples will be collected from the 0- to 4-inch depth interval. Five equal-volume aliquots will be collected at each sample location to create a single composite sample. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass. The purpose of compositing five individual aliquots from a single sampling location is to average potential small-scale heterogeneity in the physical substrate and chemical contaminant concentrations at the sample location. The compositing approach provides a more representative average exposure concentration for a given location than could be obtained from a single grab sample.

Sediments will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into pre-labeled sample containers. Horizontal positioning at each sample location will be determined using a handheld differential global positioning system receiver (DGPS). Additional sampling details are provided in the FSP (Appendix A). Laboratory sampling and analysis details and QA/QC procedures are defined in the QAPP (Appendix B).

During sampling, additional surface or subsurface sediment samples may be collected for archiving and/or for contingent chemical analysis under the following conditions:

- Additional Surface Sample Locations: If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.
- Subsurface Sampling: If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. If hydrocarbon sheen or odor is noted in more than one station subsample aliquot location, the subsurface aliquots containing the sheen or odor will be composited and archived.

If contingent surface or subsurface sediment samples are collected and archived as described above, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed, these will be analyzed using the same analysis methods used for analysis of the 30 planned surface sediment samples

## 4.3 Preliminary Screening of Human Health Risks

A baseline human health risk assessment (HHRA) will be performed as part of the RI/FS. However, this analysis will not be available to support the removal evaluation.

To support the removal evaluation, a preliminary health risk evaluation will be conducted for recreational beach users potentially exposed to the intertidal beach sediments adjacent to the former Gas Works. This preliminary analysis is intended for limited use as a screening step to assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the RI/FS. The preliminary screening evaluation is detailed in Appendix D of this Work Plan.

The preliminary screening of human health risks will be focused on potential health risks associated with cPAH compounds in sediments. This evaluation will be conducted in coordination with EPA, considering potential child and young adult exposures (i.e., individuals from birth to 30 years of age) under a recreational beach use scenario. The preliminary screening of human health risks will focus on potential risks associated with dermal contact, incidental ingestion, and inhalation of cPAH compounds in beach sediments. These compounds can be elevated in residuals associated with manufactured gas plant operations. They can also be present in petroleum hydrocarbons, combustion byproducts, treated wood structures and stormwater.

The screening-level risk evaluation will be performed as a supporting piece of information during the removal evaluation of intertidal beach sediments adjacent to the Gas Works. This evaluation is intended for limited use during the removal evaluation to help assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the Remedial Investigation/Feasibility Study (RI/FS). A baseline human health risk assessment (HHRA) and ecological risk assessment will be performed during the RI/FS, and the HHRA may supersede the screening-level risk evaluation.

The screening-level risk evaluation is presented in Appendix D, and is based on standardized equations combining site-specific and EPA default exposure information assumptions with current EPA toxicity data. In support of EPA Superfund cleanup projects, EPA has developed the Regional Screening Levels (RSL) of Chemical Contaminants at Superfund Sites. While the published RSLs are generic, they may be recalculated using site-specific data. To aid in the development of site-specific screening levels at Superfund sites, EPA has provided a web-based RSL calculator. The "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website provides the calculator, a user’s guide, links to EPA guidance, and answers to frequently asked questions regarding the use of screening levels[1]. All computations for the preliminary recreational beach user screening evaluation were done using the RSL calculator and are provided in Appendix D.

The EPA recreational soil/sediment exposure was used for the current analysis. All assumptions provided with EPA default values were used. Conservative site-specific exposure frequency (days/year) and event time (hours/event) were used as described below.

Beach play exposure frequency values have been evaluated recently by EPA at other marine sediment sites with similar accessibility and characteristics, including at the Lower Duwamish Waterway (LDW) Superfund Site. The beach play exposure analysis for the LDW Site was summarized in the final HHRA performed during the RI/FS study process (Windward 2007), and used an exposure frequency of 65 days/year. This is more conservative than the exposure frequency used by the Washington Department of Ecology (Ecology 2012) in its generic beach play scenario (41 days/year) for developing cleanup levels at State-lead cleanup sites.

The preliminary recreational beach user scenario to be used at the Site will use an exposure frequency of 65 days per year. This exposure frequency represents the 95th percentile for children from birth to 6 years of age who engage in playing and digging in the sand adjacent to the water and is based on a King County survey of established parks (Lake Union, Lake Washington, and Lake Sammamish) with sandy beaches (Parametrix 2003). These King County park areas are likely to have higher visitation rates than the beach adjacent to the Bremerton Gas Works Site located on the Port Washington Narrows.

The event time for the assumed recreational beach user scenario is 6 hours per event. This value is conservative for a tidally-inundated beach area. This value is applied to the

[1] EPA 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

estimate of inhalation exposure. For the purpose of developing the preliminary beach user exposure screening evaluation, this value was assumed to be 6 hours per visit. Because cPAH compounds have very low volatility, the estimated exposure is very low and the contribution to risk is approximately four orders of magnitude lower than for soil ingestion or dermal contact. Regardless, the preliminary beach user scenario is based on all three exposure pathways, inhalation of soil vapor, and soil ingestion and dermal contact, consistent with the RSL calculation methods.

The preliminary recreational beach user scenario results in a protective total cPAH TEQ concentration of 8 mg/kg at the $10^{-4}$ risk level and 0.08 mg/kg at the $10^{-6}$ risk level. The details of this calculation are provided in Appendix D, and Table D-3 provides the input and output values from the EPA RSL calculator.

For the Removal Evaluation Report, surface sediment analytical data will be summarized in tables and presented on figures depicting station sample concentrations of total cPAH TEQ results. The evaluation of the risk screening results will be performed in coordination with EPA.

## 4.4 Preliminary Screening for Potential Benthic Impacts

Potential risks associated with direct contact exposure to sediment by the benthic invertebrate community will also be evaluated during the removal evaluation. Washington's SMS regulations contain promulgated criteria for the protection of benthic communities. The chemical-specific criteria contained within the SMS are Applicable or Relevant and Appropriate Requirements (ARARs) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will be considered as part of the RI/FS at the Site. There are no corresponding chemical-specific federal ARARs that apply to the protection of marine benthic communities. The SMS are not intended for direct application to the Site during the removal evaluation, but will provide a useful point of reference for evaluating the likelihood that existing sediment quality may impact benthic communities in the beach area.

The SMS criteria for PAH contamination includes two groups of PAH compounds known as HPAH and LPAH. PAHs are non-polar organic compounds and preferentially bind with organic carbon (OC). Normalization of sediment PAH data to TOC is a standard practice because the bioavailability of PAHs in sediment is controlled by OC content. Therefore Ecology has promulgated PAH standards based on OC normalized data. Normalizing PAH data by dividing by the fraction of OC is appropriate when TOC concentrations are between 0.5 percent and 5 percent, the typical range of TOC for marine sediments (Ecology 2012). Outside of this range, the SMS standards are applied on a dry weight basis. For sediments between 0.5 percent and 5 percent, the OC normalized SMS for HPAH and LPAH are 980 mg/kg-OC and 370 mg/kg-OC, respectively. For sediments outside of the TOC range for normalization, the dry weight SMS standards for HPAH and LPAH are 12 mg/kg and 5.2 mg/kg, respectively.

For the evaluation of potential risk to the benthic community, the individual sample data will be compared to the SMS numeric criteria. For samples within the TOC range of 0.5 percent to 5 percent, the comparison will be made comparing TOC-normalized data and SMS criteria. For samples with less than 0.5 percent TOC or greater than 5 percent TOC, the comparison will be made comparing dry weight data and SMS criteria.  Results will be expressed as multiples of the SMS criteria.

# 5 Inspection of Former Drainage and Piping System

The 2010 TCRA involved removing and plugging a portion of the Pipe buried in the intertidal area along Port Washington Narrows (as described in detail in Section 2.3 and shown in Figure 2). Based on observations made during the TCRA and a review of the sewer record drawings, the Pipe appears to have been a former sewer overflow pipe. The Pipe and the associated drainage system (including catch basins, manholes, and connecting pipes) are shown on the City of Bremerton sewer cards provided in Appendix C. Locations of former and current drainage and piping system components at the Site were georeferenced from the City of Bremerton file information and are shown on Figure 3.

The sewer record drawings show the Pipe extending from a manhole located on the Sesko Property (Manhole "A") to the Port Washington Narrows. An effluent pipe from Manhole "A" is labeled as abandoned. Influent pipes to Manhole "A" noted on the drawings include the following:

- A 12-inch-diameter overflow pipe coming from a manhole (Manhole "D") located to the southwest of Manhole "A." The two influent pipes to Manhole "D" are noted as abandoned.
- A 10-inch-diameter overflow pipe coming from a manhole (Manhole "E") located 22 feet east-northeast of Manhole "A." The pipes entering and exiting Manhole "E" are noted as abandoned, and Manhole "E" is noted as plugged and filled with concrete.
- A 6-inch-diameter inlet pipe coming from the northwest. The full length of the 6-inch pipe is not shown, and its source and status are unknown. We are not aware of any current structures, catch basins, or other potential active connections to the sewer system northwest of Manhole "A." The Gas Works plant building was formerly located in this direction.
- A "drain" line extending from two areas south of Manhole "A": a catch basin located near Manhole "D," and a former gasoline tank containment area located on the Sesko Property. The former gasoline tank containment area is unrelated to the former Gas Works. The status of the drain line is not known.

During the TCRA, a manhole cover was observed in the approximate location where Manhole "A" is indicated on the drawings. Discussions with a contractor of Natasha Sesko and field observations indicate that the manhole had been filled with debris.

Based on the available data, it is unclear whether all of the influent lines entering Manhole "A" have been plugged or removed. If stormwater is entering Manhole "A," then it may enter the Pipe; however, no stormwater discharge is likely because the end of the Pipe was plugged during the TCRA. The removal evaluation will assess whether abandonment of Manhole "A" is necessary to prevent stormwater from entering the Pipe and mobilizing contamination, if any, present within the remaining Pipe.

Based on the sewer record drawings, Manhole “A” is approximately 16 feet deep. To further evaluate the potential need for a removal action to address the manhole, the following activities will be performed during the removal evaluation:

- Field survey to locate potential influent sources to Manhole “A”, including: 1) an inspection for the origin of the 6-inch-diameter influent pipe entering the manhole from the northwest, and 2) an inspection to locate and assess the condition of the drain lines and associated catch basin to the south of the manhole.
- Review of surface topography and conditions around the manhole to evaluate the potential for stormwater to enter the manhole.

# 6 Bluff Inspection and Contingent Sampling

Inspection and contingent sampling will be conducted along the boundary between the upland area of the Site (the “bluff”) and the beach to evaluate whether there is an exposed contaminant migration pathway from the upland area to the sediment and/or surface water of Port Washington Narrows through either the erosion of bluff soil or direct discharge of hydrocarbon product.

The bluff inspection area will extend west to east from approximately the Thompson Avenue right-of-way to the Pennsylvania Avenue right-of-way as shown in Figure 5. The inspection will include the soils at the base of the bluff.

The bluff inspection will consist of the following:

- Observing exposed soils in the lower bluff area.
- Inspect and document any evidence of hydrocarbon staining, hydrocarbon odors in conjunction with a PID or FID, or seeps containing potential hydrocarbon sheen or product.
- Collect and archive samples of bluff soil where observed to contain hydrocarbon staining, sheen or odors.
- Collect and archive samples of liquid seeps (if feasible), where observed to contain potential hydrocarbon sheen or product.
- If contingent soil or seep liquid samples are collected and archived, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples.

# 7 Project Reporting and Schedule

This section describes the project schedule and reporting, consistent with AOC requirements.

## 7.1 Data Management and Reporting

Two types of data will be generated for this project: field data and laboratory data. Procedures for transmitting and reporting each type of data are described below.

- Field Data: Field measurements and observations will be recorded in logbooks or on appropriate field forms. The field team members should review the field data for completeness or errors daily before submitting the forms to the Task Manager. Field data forms, including groundwater sampling forms and boring logs, will be reviewed daily by the Task Manager. The Site logbook, daily reports, and copies of field data forms will be maintained by Anchor QEA and/or Aspect as required by the AOC.
- Laboratory Data: The laboratory data reports will be archived electronically. The electronic data deliverable will be uploaded into the project database. All data entered into the database will be compared to hard copy laboratory data and/or electronic laboratory submittals and to data validation reports to ensure the correct data have been entered before use and archiving.

Consistent with the AOC, a Removal Evaluation Report will be submitted to EPA following completion of the removal evaluation. The Removal Evaluation Report shall include the following:

- Locations, lab reports and summary of results of sample collection and analysis.
- Quality assurance review of analytical data.
- Conceptual site model for area sampled.
- Evaluation of Potential Removal Actions: To the extent conditions are identified during the removal evaluation indicating contaminant migration pathways at the Site pose an imminent and substantial endangerment to public health or welfare or the environment that should be addressed before completion of the RI/FS, then the Removal Evaluation Report shall include a description of one or more potential removal actions that could be conducted to mitigate this risk. This description shall include a summary of the migration pathways requiring control, the data available describing such pathways, and the specific actions recommended to control such pathways. Any proposed removal action shall, to the extent practicable, be consistent with the RI/FS, and shall be consistent with and facilitate final remediation of the Site. Proposed removal actions approved by EPA shall be performed under the AOC.
- The Removal Evaluation Report shall be based on information and data available at the time the report is submitted to EPA.

## 7.2 Schedule

Field sampling will be performed as soon as practicable after EPA approval of this Work Plan (including the FSP and the QAPP). If practicable, and depending on the schedule for EPA review and comment, field sampling will be performed during the daytime low tides of summer 2013. The proposed sampling dates will be confirmed with EPA after receipt of EPA review comments and/or approval of this Work Plan.

All removal evaluation activities will comply with the schedule defined in the AOC and SOW, unless an alternative schedule is approved by EPA. These activities as defined in the SOW include, but are not limited to, development of the final Removal Evaluation Work Plan and development of the draft and final Removal Evaluation Report.

# 8 References

Anchor QEA, LLC (Anchor QEA), and Aspect Consulting (Aspect), 2010. Final Work Plan: Former Bremerton MGP Site, Incident Action and Time Critical Removal Action. Prepared for U.S. Coast Guard Sector Puget Sound Incident Management Division on behalf of Cascade Natural Gas Corporation. November 4, 2010.

Anchor QEA. 2011. Final Completion Report: Former Bremerton MGP Site, Incident Action and Time Critical Removal Action. Prepared for U.S. Coast Guard Sector Puget Sound Incident Management Division on behalf of Cascade Natural Gas Corporation. January.

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Ecology 2012. Draft Sediment Cleanup Users Manual II Guidance for Implementing the Sediment Management Standards, Chapter 173-204 WAC. August 2012. Publication no. 12-09-057.

EPA (U.S. Environmental Protection Agency). 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. July 1993. EPA/600/R-93/089

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EPA. 2012. “Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

GeoEngineers, 2007. Preliminary Upland Assessment Report, McConkey/Sesko Brownfields Site. Prepared for City of Bremerton. October 26, 2007.

Hart Crowser, 2007. Historical Characterization and Data Gaps, Old Bremerton Gasworks Property 1725 Pennsylvania Avenue. Prepared for Washington State Department of Ecology. May 2, 2007.

Parametrix. 2003. Results of a human use survey for shoreline areas of Lake Union, Lake Washington, and Lake Sammamish. Sammamish-Washington Analysis and Modeling

Program (SWAMP). Prepared for King County Department of Natural Resources. Parametrix, Kirkland, WA. http://green.kingcounty.gov/lakes/reports/shorelineusage.aspx

Techlaw, 2006. Targeted Brownfields Assessment Report, Old Bremerton Gas Works - McConkey Properties. Prepared for U.S. Environmental Protection Agency. November 10, 2006.

Washington State Department of Ecology. 2012. Draft Sediment Cleanup Users Manual II, Guidance for Implementing the Sediment Management Standards, Chapter 173-204 WAC. August 2012. Publication no. 12-09-057

Windward. 2007. Lower Duwamish Waterway Remedial Investigation, Appendix B, Baseline Human Health Risk Assessment, Final. November 12.

# TABLES

**Table 1**
**Project Personnel and Subcontractors**

| Name | Organization | Project Title | Project Role | Mailing Address | Email Address | Office Phone | Cell Phone |
|---|---|---|---|---|---|---|---|
| **Representatives** | | | | | | | |
| Kalle Godel | Cascade Natural Gas | | Site representative and Cascade Project Coordinator | 400 N 4th Street, Bismark, North Dakota 58501 | Kalle.Godel@mdu.com | (701) 222-7657 | (701) 471-0927 |
| **Consultants** | | | | | | | |
| Jeremy Porter | Aspect Consulting | Project Manager | Aspect project manager | 401 2nd Avenue South, #201 Seattle, Washington 98104 | jporter@aspectconsulting.com | (206) 838-5835 | (206) 790-2129 |
| Carla Brock | Aspect Consulting | Task Manager - Upland Investigation | Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met. | 401 2nd Avenue South, #201 Seattle, Washington 98104 | cbrock@aspectconsulting.com | (206) 838-6593 | (425) 269-7255 |
| Mark Larsen | Anchor QEA | Project Manager | Anchor QEA project manager | 1119 Pacific Avenue, Suite 1600 Tacoma, Washington 98402 | mlarsen@anchoroqea.com | (206) 903-3359 | (206) 310-2263 |
| Ed Berschinski | Anchor QEA | Project Technical Advisor | Anchor QEA technical advisor regarding removal evaluation | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | eberschiniski@anchorqea.com | (206) 903-3315 | (206) 819-6099 |
| David Templeton | Anchor QEA | Project Health and Safety Manager | Anchor QEA health and safety manager | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | dtempleton@anchorqea.com | (206) 903-3312 | (206) 910-4279 |
| Dan Hennessy | Anchor QEA | Task Manager - Sediment Investigation | Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met. | 1605 Cornwall Avenue Bellingham, Washington 98225-4427 | dhennessy@anchorqea.com | (360) 733-4311 | (206) 491-0610 |
| Nathan Soccorsy | Anchor QEA | Field Safety Officer/Coordinator | Reports to the Task Manager. Ensures all project health and safety requirements are followed; coordinates and participates in the field sampling activities; coordinates sample deliveries to lab; coordinates sampling activities with Site owner and subcontractors; report to the Task Manager any deviations from the project plans. | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | nsoccorsy@anchorqea.com | (206) 903-3385 | (480) 272-2805 |
| Delaney Peterson | Anchor QEA | Project QA Manager | Coordinates with laboratory to ensure that SQAPP requirements are followed and that laboratory QA objectives are met. | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | dpeterson@anchorqea.com | (206) 903-3396 | (206) 919-2845 |
| Laurel Menoche | Anchor QEA | Project Data Manager | Ensures that analytical data is incorporated into Site database with appropriate qualifiers following validation | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | lmenoche@anchorqea.com | (206) 903-3372 | |
| **Environmental Protection Agency (EPA)** | | | | | | | |
| William Ryan | EPA | EPA Remedial Project Manager | Overall project management | 1200 6th Ave Suite 900 ECL-113 Seattle, Washington 98101 | ryan.william@epa.gov | (206) 553-8561 | |
| Kathy Parker | EPA | EPA On Scene Coordinator | Coordinate with EPA RPM on topic related to Removal Evaluation and implementation of early actions at the Site | 1200 6th Ave Suite 900 ECL-116 Seattle, Washington 98101 | parker.kathy@epa.gov | (206) 553-0062 | (206) 321-3796 |
| Ginna Grepo-Grove | EPA | EPA Region 10 QA Manager | RI/FS technical support QA/QC issues | 1200 6th Ave Suite 900 OEA-95 Seattle, Washington 98101 | Grepo-Grove.Gina@epamail.epa.gov | (206) 553-1632 | |
| **Subcontractors** | | | | | | | |
| Cheronne Oreiro | Analytical Resources, Inc. | Laboratory Manager | Soil and sediment analysis | 4611 South 134th Place , Suite 100 Tukwila, Washington 98168 | Cheronneo@arilabs.com | (206) 695-6214 | |

**Table 2**
**Proposed Removal Evaluation Surface Sediment Explorations**

| Station ID | Sample Collection Method | Depth Interval | Media | Sampling DQO[2] | Analytical Chemistry | Coordinates[3] Northing (Y) | Easting (X) |
|---|---|---|---|---|---|---|---|
| **Removal Evaluation Intertidal Beach Surface Sediment Sampling [1]** | | | | | | | |
| BGW-RE-SG-01 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216322.04 | 1193634.86 |
| BGW-RE-SG-02 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216356.85 | 1193634.86 |
| BGW-RE-SG-03 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216388.50 | 1193635.20 |
| BGW-RE-SG-04 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216308.24 | 1193734.86 |
| BGW-RE-SG-05 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216343.50 | 1193734.86 |
| BGW-RE-SG-06 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216379.86 | 1193734.86 |
| BGW-RE-SG-07 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216304.94 | 1193834.86 |
| BGW-RE-SG-08 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216330.55 | 1193834.86 |
| BGW-RE-SG-09 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216357.04 | 1193834.86 |
| BGW-RE-SG-10 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216293.40 | 1193912.72 |
| BGW-RE-SG-11 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216323.54 | 1193918.27 |
| BGW-RE-SG-12 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216279.67 | 1193934.86 |
| BGW-RE-SG-13 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216312.36 | 1193945.00 |
| BGW-RE-SG-14 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216244.75 | 1193934.86 |
| BGW-RE-SG-15 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216281.23 | 1193957.16 |
| BGW-RE-SG-16 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216307.60 | 1193965.51 |
| BGW-RE-SG-17 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216227.43 | 1193953.99 |
| BGW-RE-SG-18 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216200.00 | 1193967.25 |
| BGW-RE-SG-19 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216218.60 | 1193979.11 |
| BGW-RE-SG-20 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216285.77 | 1194021.95 |

**Table 2**
**Proposed Removal Evaluation Surface Sediment Explorations**

| Station ID | Sample Collection Method | Depth Interval | Media | Sampling DQO[2] | Analytical Chemistry | Coordinates[3] Northing (Y) | Easting (X) |
|---|---|---|---|---|---|---|---|
| BGW-RE-SG-21 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216198.47 | 1194007.68 |
| BGW-RE-SG-22 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216230.19 | 1194027.96 |
| BGW-RE-SG-23 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216286.01 | 1194041.83 |
| BGW-RE-SG-24 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216203.04 | 1194034.86 |
| BGW-RE-SG-25 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216235.69 | 1194050.42 |
| BGW-RE-SG-26 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216275.79 | 1194064.71 |
| BGW-RE-SG-27 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216234.33 | 1194080.61 |
| BGW-RE-SG-28 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216201.65 | 1194134.94 |
| BGW-RE-SG-29 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216225.63 | 1194134.94 |
| BGW-RE-SG-30 | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216248.75 | 1194135.08 |
| BGW-RE-SG-XX (Field duplicate 1) | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess sample variability and the nature and extent of surface contamination | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-SG-XX (Field duplicate 2) | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess sample variability and the nature and extent of surface contamination | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-SG-RB | Rinse blank | N/A | Distilled water | Assess equipment decontamination procedures | SIM-PAH | N/A | N/A |

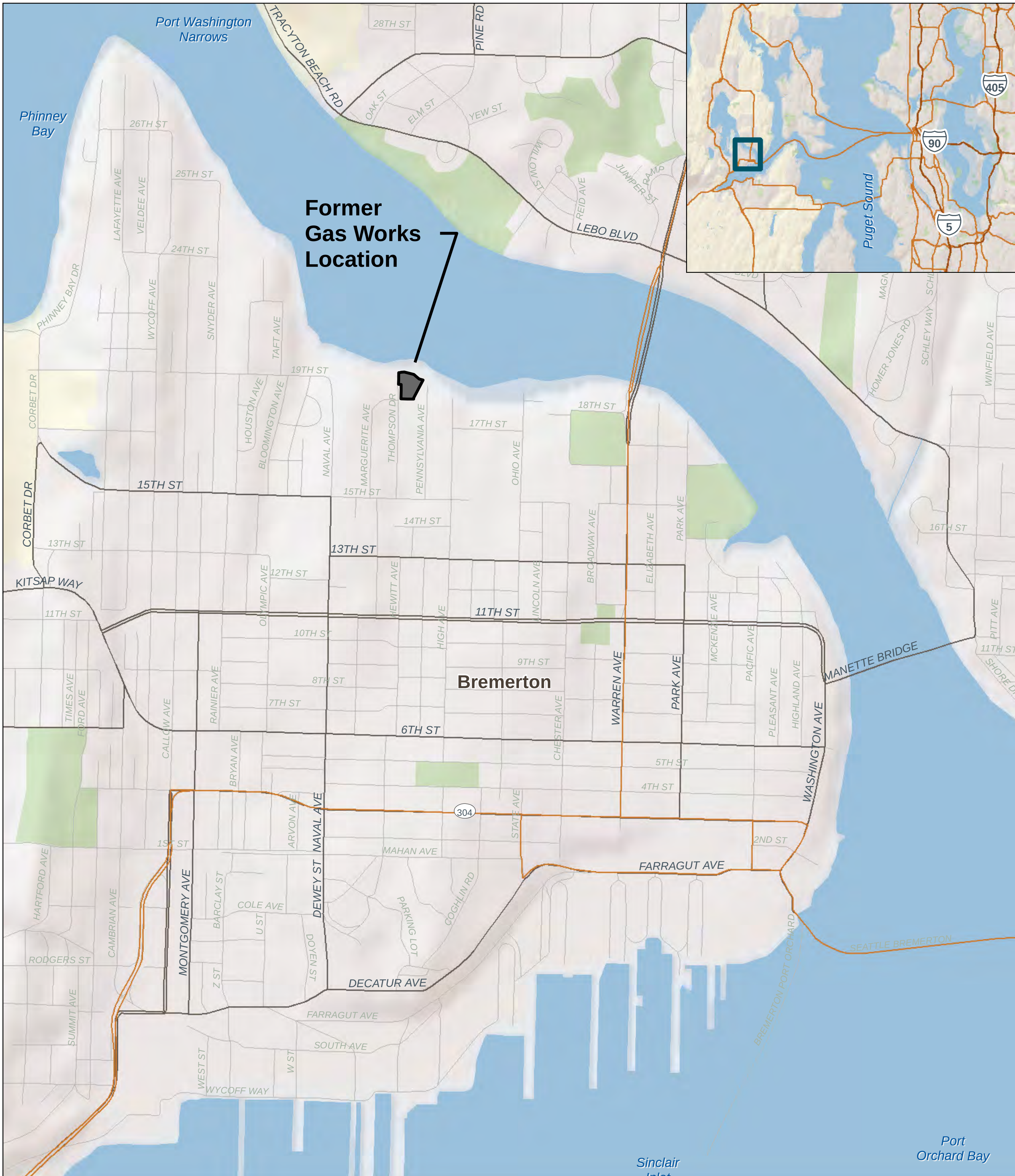
Notes
1: If hydrocarbon sheen or odor is observed in during bulk sediment sampling, an additional opportunistic sample from the 4-12 inch interval will be collected and archived. The decision to analyze the opportunistic sample will be made in consultation with EPA.
2: Each station sample will consist of five equal volume aliquots. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass.
3: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon. High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
SG - Sediment Grab
TBD - To be determined
N/A - Not applicable

**Table 3**
**Removal Evaluation Contingent Bluff Soil or Seep Liquid Samples**

| Sample ID | Sample Collection Method | Depth Interval | Media | Sampling DQO | Analytical Chemistry | Coordinates[1] | |
|---|---|---|---|---|---|---|---|
| | | | | | | Northing (Y) | Easting (X) |
| **Contingent Soil or Seep Liquid Sampling** | | | | | | | |
| BGW-RE-BS-01 | Hand collection with stainless steel trowel | TBD | Soil | Assess nature of contamination from bluff soil | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-BS-02 | Direct collection | N/A | Liquid | Assess nature of contamination from seep liquid | Archive | TBD | TBD |
| BGW-RE-BS-XX (Field duplicate) | Hand collection with stainless steel trowel | TBD | Soil | Assess sample variability and nature of contamination from bluff soil | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-BS-RB | Rinse blank | N/A | Distilled water | Assess equipment decontamination procedures | SIM-PAH | N/A | N/A |

Notes
1: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon.  High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
BS - Bluff Sample
TBD - To be determined
N/A - Not applicable

# FIGURES




AQ GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_06\Vicinity_Map_Work_Plan_and_SQAPP (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: ckiblinger || Print Date: 6/7/2013

N

0 750 1,500

Feet

1:18,000

**NOTE:**
If a paper copy is required, this figure is best printed in color.

# Former Gas Works Location and Vicinity Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

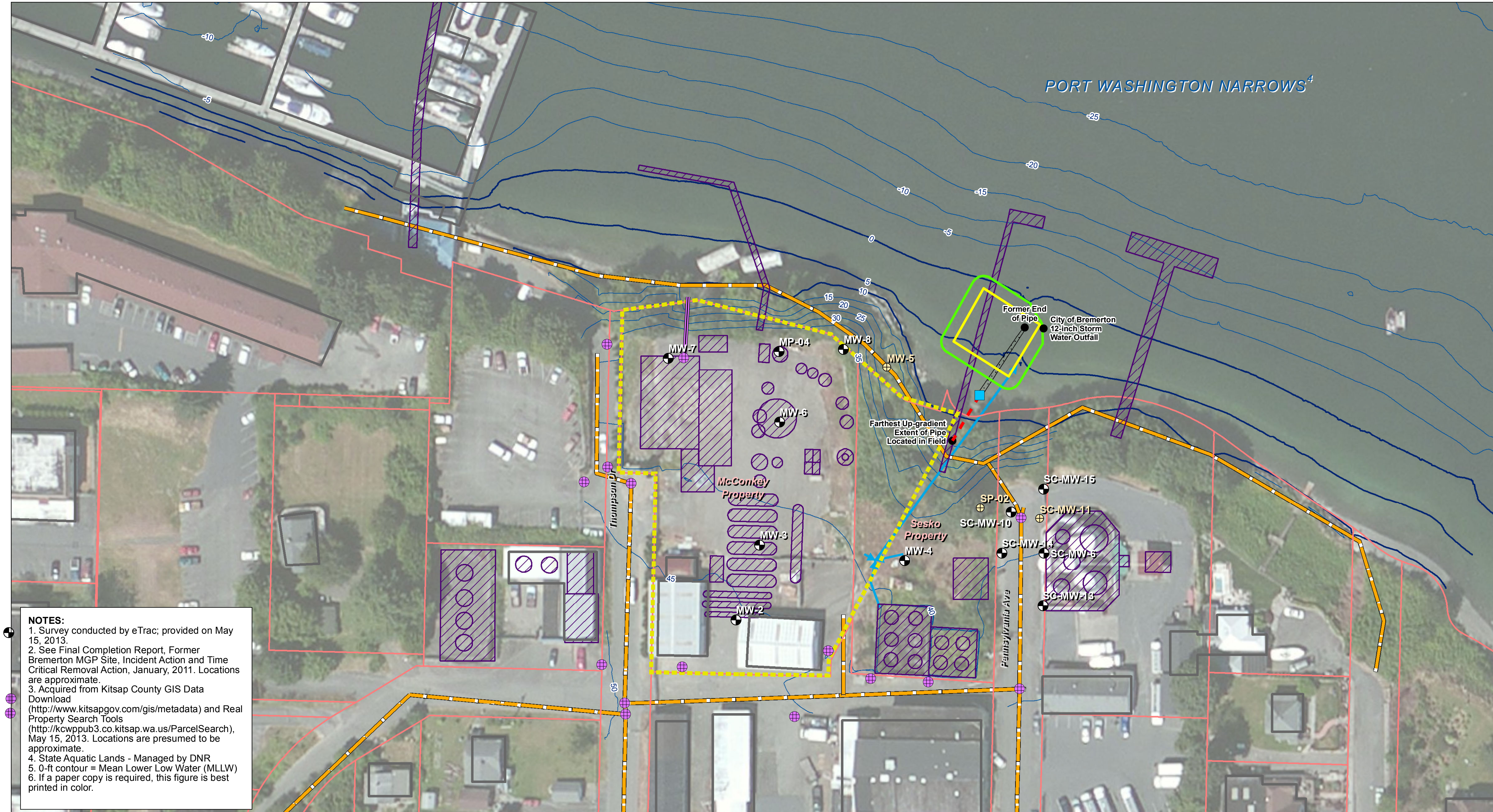
Aspect CONSULTING

ANCHOR QEA

FIRM: ANCHOR QEA

DRAWN BY: ckiblinger

FIGURE NO. **1**




**NOTES:**
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

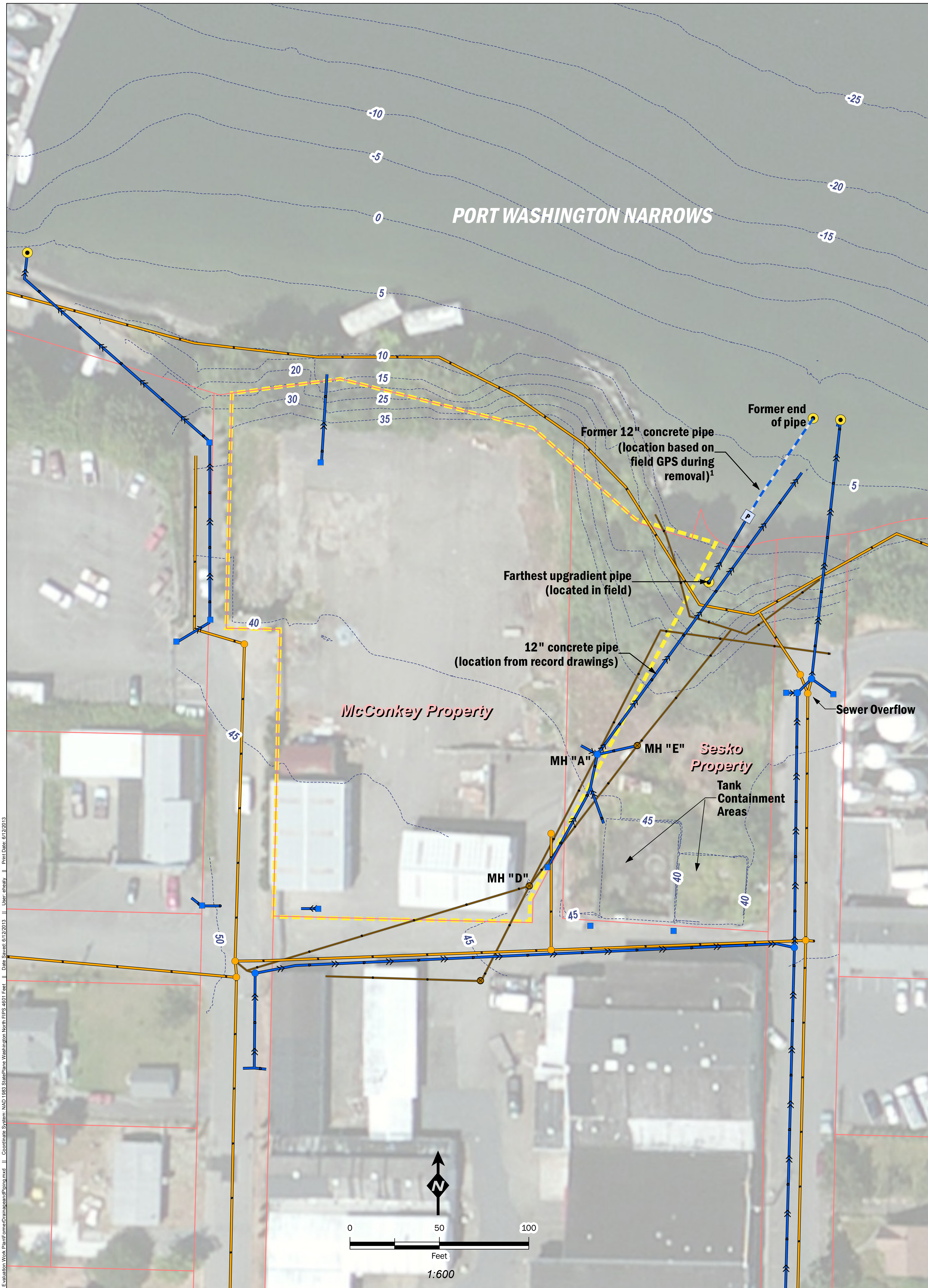
- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Extent of Organo-Clay Mat[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Approximate Monitoring Well Location (Not Surveyed)
- Surveyed Monitoring Well Location
- Current Stormwater Structures
- On-site Drainage Feature
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Historical Structures
- Existing Buildings
- Former Gas Works Location
- Parcel Boundaries[3]

N

0 75 150
Feet
1:900

# Historical and Current Site Features
## Removal Evaluation Work Plan
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ANCHOR QEA | DRAWN BY: dhennessy | FIGURE NO. 2




## LEGEND

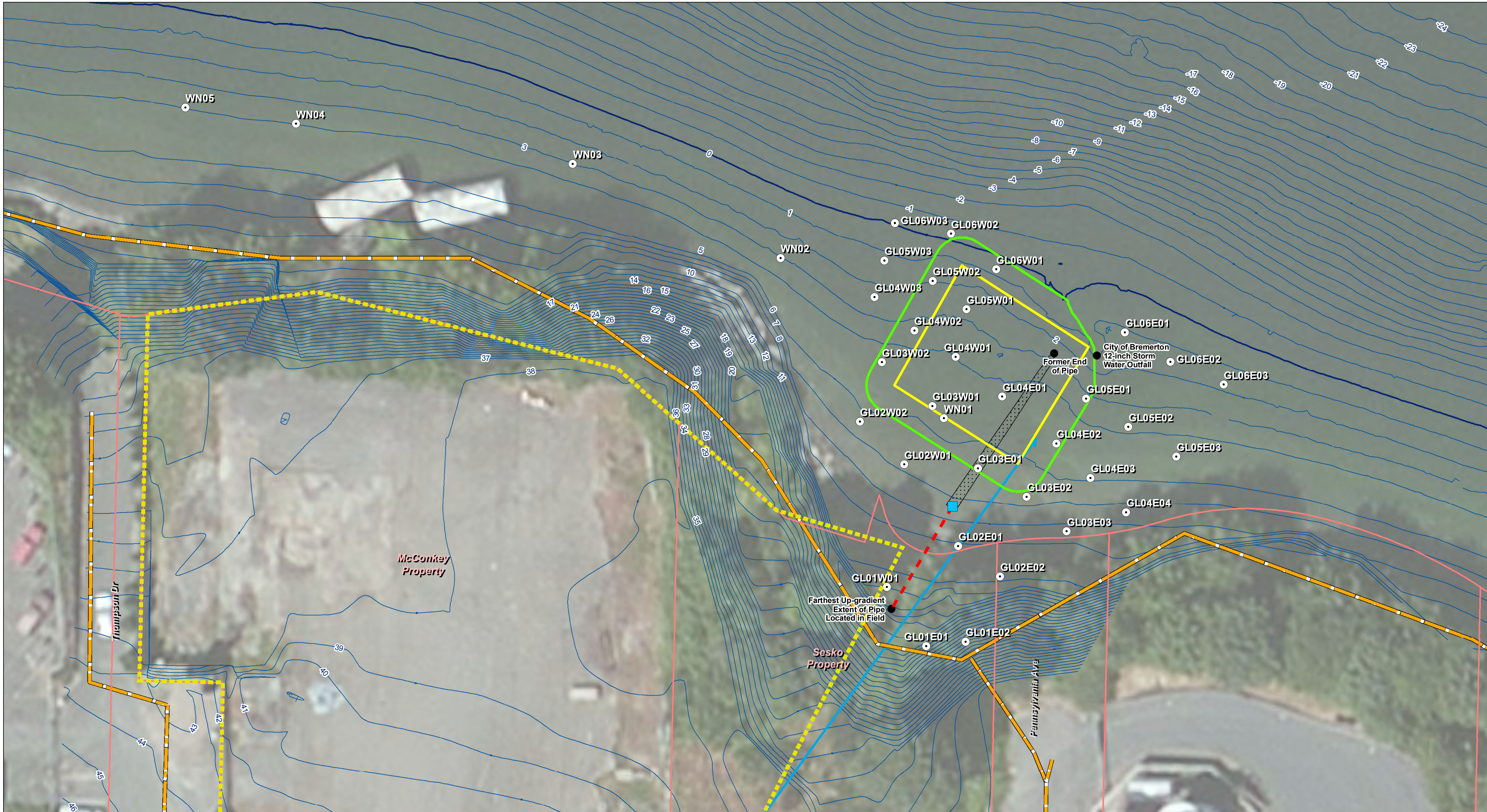
- Storm Manhole
- Catch Basin
- Pipe Plug Location[1]
- Sewer Manhole
- Abandoned Sanitary Sewer Manhole
- Outfall
- Removed Storm Sewer
- Storm Sewer
- Sanitary Sewer
- Abandoned Sewer
- Former Gas Works Property Boundary
- Surveyed 5-Foot Topographic and BathymetricElevation Contours (MLLW vertical datum)
- Tax Parcel Boundary (based on Kitsap County GIS)

**Notes:**
1) See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January 2011 - Locations are approximate.
2) If a paper copy is required, this figure is best printed in color.

# Location of Former Drainage & Piping System

Removal Evaluation Work Plan
Bremerton Gas Works Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ASPECT | DRAWN BY: EAH / PPW | FIGURE NO. 3




- Historical Data
- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Extent of Organo-Clay Mat[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

**NOTES:**
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

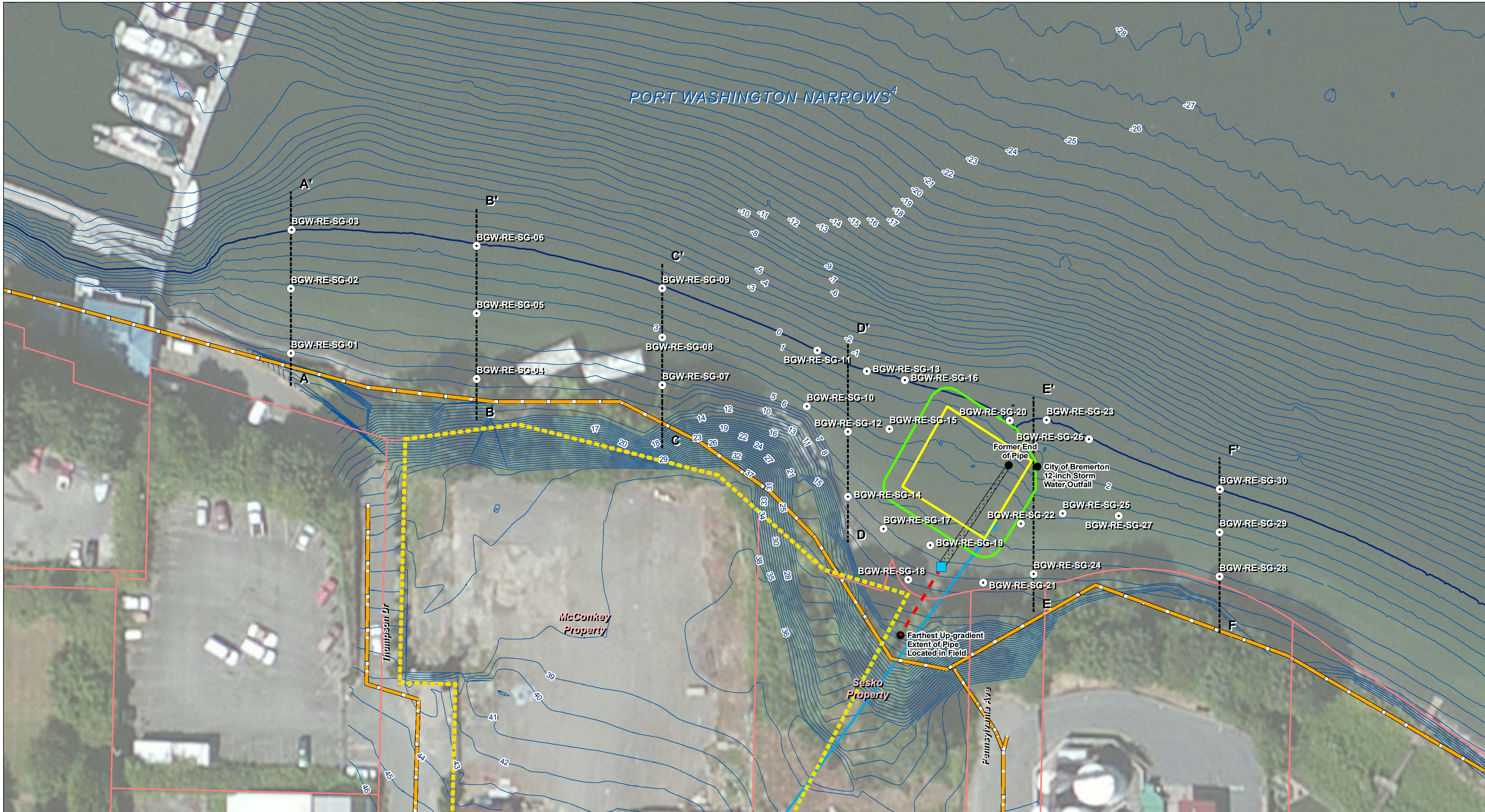
N

0 25 50
Feet
1:400

# Historical Sampling Locations
# Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ANCHOR QEA | DRAWN BY: dhennessy | FIGURE NO. 4




- ● Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Extent of Organo-Clay Mat[2]
- Proposed Sampling Locations
- 100-Foot Transects
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

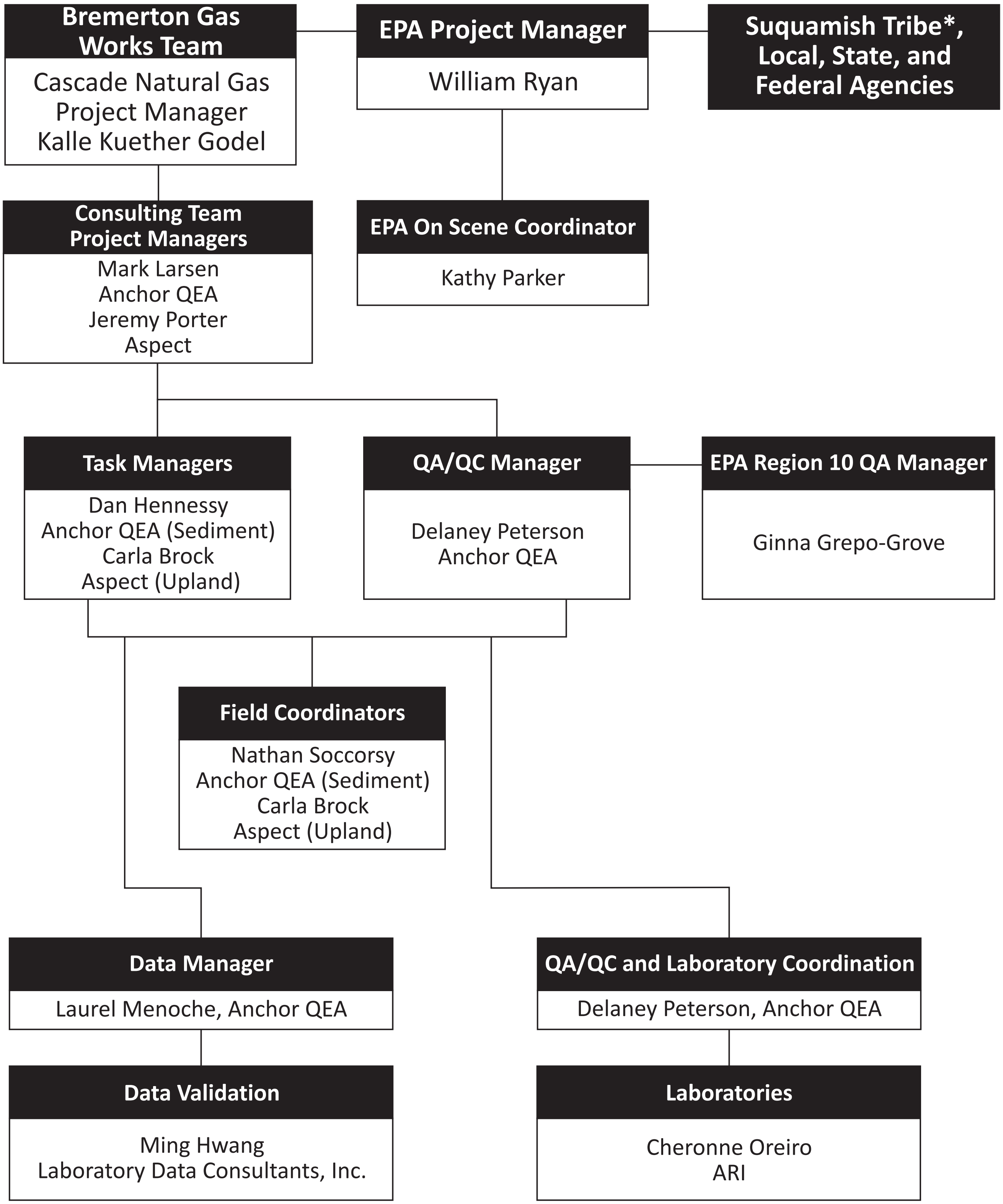
**NOTES:**
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

N

0 50 100
Feet
1:600

**Removal Evaluation Intertidal Sampling Locations**
**Removal Evaluation Work Plan**
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING | ANCHOR QEA | FIRM: ANCHOR QEA DRAWN BY: dhennessy | FIGURE NO. 5




* EPA will coordinate with the Suquamish Tribe, a support agency providing review and other assistance as requested by EPA. EPA will also coordinate with Local, State, and Federal agencies and other stakeholders, as necessary.

06/19/2013 dholmer K:\Projects\1014-Veris Law Group, PLLC\Bremerton Gasworks Site RI-FS\ORG CHARTS.cdr

ANCHOR QEA

**Figure 6**
Project Organization
Bremerton Gasworks Site RI/FS

# APPENDIX A
# FIELD SAMPLING PLAN

# APPENDIX A
# FIELD SAMPLING PLAN
# FINAL REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by


Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

# APPENDIX A
# FIELD SAMPLING PLAN
# FINAL REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC & Anchor QEA, LLC

## Approvals:

| | |
|---|---|
| Project Manager<br>Jeremy Porter, Aspect | Date |
| Project Manager<br>Mark Larsen, Anchor QEA | Date |
| EPA Remedial Project Manager<br>William Ryan, EPA | Date |
| EPA Project On Scene Coordinator<br>Kathy Parker, EPA | Date |
| EPA Region 10 QA Manager<br>Ginna Grepo-Grove, EPA | Date |

## Contents



## List of Tables



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# Acronyms

| | |
|---|---|
| AOC | Administrative Settlement Agreement and Order on Consent |
| ARI | Analytical Resources, Inc. |
| ASTM | American Society for Testing and Materials |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| DNAPL | dense non-aqueous phase liquid |
| DQOs | data quality objectives |
| EPA | U.S. Environmental Protection Agency |
| FC | field coordinator |
| FID | Flame Ionization Detector |
| FM | Field Manager |
| FSDS | field sampling data sheet |
| FSP | Field Sampling Plan |
| Gas Works | Former Bremerton gas works facility |
| HARN | High Accuracy Reference Network |
| IDW | investigation derived waste |
| MS/MSD | matrix spike/matrix spike duplicate |
| µg/L | microgram per liter |
| NAD | North American Datum |
| NAVD 88 | North America Vertical Datum 1988 |
| NELAP | National Environmental Laboratories Accreditation Program |
| PAH | polycyclic aromatic hydrocarbons |
| PID | Photoionization Detector |
| PM | project manager |
| PSEP | Puget Sound Estuary Program |
| PPE | personnel protective equipment |

| | |
|---|---|
| QAPP | Quality Assurance Project Plan |
| QA/QC | quality assurance/quality control |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| SOW | Statement of Work |

# 1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gas Works Site (Site), Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013. Figure A-1 shows the location of the former Bremerton Gas Works facility (Gas Works).

The first task required under the AOC is the completion of a removal evaluation. This Field Sampling Plan (FSP) is Appendix A to the Removal Evaluation Work Plan (Work Plan). The field sampling described in this FSP includes collection and chemical analysis of sediment samples from the intertidal beach area adjacent to the Site. As described in the Work Plan, a Time Critical Removal Action (TCRA) was performed in a portion of this area during 2010 in order to control the release of hydrocarbon sheen from a historical drain pipe. The sediment data collected during the current effort will be used to assess current conditions in the beach area, and to determine whether releases or threatened releases from the Site present an imminent and substantial endangerment to public health or welfare or the environment which warrants performance of a removal action before completion of the RI/FS and selection of a final remedy. Field sampling will also include completion of an inspection of existing drainage system components at the former Gas Works location, and an inspection of conditions along the bluff between the former Gas Works and the intertidal beach area.

Appendix B of the Work Plan specifies the Quality Assurance Project Plan (QAPP). Compliance with the FSP and QAPP will ensure that sample collection and analytical activities result in data meeting project data quality objectives (DQOs). The FSP and QAPP address the three DQOs developed in the Work Plan and the methods for planning and meeting those objectives. These three DQOs are as follows:

- Collect the information necessary to evaluate whether current surface sediment contamination (0 to 4 inch depth interval) within the intertidal beach area adjacent to the former Gas Works poses a substantial and imminent threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC. The extent of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line will be characterized as specified in the AOC. These data will be used to estimate potential Site-related risks to beach users (evaluated using a child-exposure beach play scenario) and to benthic ecological receptors. If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Anchor QEA will lead this field task.

- Inspect the former drainage and piping system connected to the 12-inch pipe addressed by the TCRA by surveying and locating potential influent sources to

Manhole "A." These data will be used to identify potential ongoing or threatened contaminant migration pathways to the beach. Aspect will lead this field task.

- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, soil samples will be collected and archived. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples, as described in Section 3 of this FSP. Aspect will lead this field task.

This FSP also provides the basis for planning field activities, and establishes specific quality assurance requirements, which are presented in the QAPP. This FSP is organized into the following sections:

- Section 2 – Project Management and Responsibilities
- Section 3 – Sediment Sample Collection, Processing and Handling Procedures
- Section 4 – Drainage System Inspection
- Section 5 – Bluff Inspection and Sampling
- Section 6 - Chemical Testing
- Section 7 – Field Sampling Schedule
- Section 8 – References
- Attachment A-1 – Field Forms
- Attachment A-2 – Removal Evaluation Investigation and Sampling Training Checklist

# 2 Project Management and Responsibilities

This section describes the overall project management strategy for implementing and reporting of the field activities. Section 3.1 of the QAPP identifies key project management personnel and their roles and responsibilities.

As described in the QAPP, the project managers (PMs) for Anchor QEA and Aspect will be responsible for overall project coordination, including production of all project deliverables and administrative coordination to assure timely and successful completion of the project.

The Anchor QEA or Aspect field coordinator (FC) will be responsible for day-to-day technical and quality assurance/quality control (QA/QC) oversight for their respective tasks. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical analyses. The FC will be assisted by additional personnel at Anchor QEA, as necessary. The data and QA/QC managers will be responsible for coordination and oversight of data validation and data management, and will report to the PMs.

The designated laboratory will be qualified and experienced in the analysis of environmental samples. As described in the QAPP, the laboratory manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The analytical laboratory will be responsible for the following:

- Performing the methods outlined in the QAPP and attachments, including those methods referenced for each analytical procedure.
- Following documentation, custody, and sample logbook procedures.
- Meeting all reporting and QA/QC requirements.
- Delivering electronic data files and deliverables as specified in the QAPP and attachments.
- Meeting turnaround times for deliverables as described in QAPP and attachments.
- Allowing EPA and the QA/QC manager to perform laboratory and data audits.
- Providing certified, pre-cleaned sample containers.

Table A-1 provides the names and contact information for project personnel and subcontractors.

# 3 Sediment Sample Collection, Processing, and Handling Procedures

The following sections describe the sediment sample collection, processing, and handling procedures to be followed during the removal evaluation. Sample locations are shown in Figure A-2. The QAPP details the quality assurance/quality control protocols to be followed during these activities.

## 3.1 Surface Sediment Sample Collection Procedures

Surface sediment samples will be collected at low tide at each of the locations defined in Figure A-2 and Table A-3. These sampling locations are consistent with the requirements of the AOC, and with EPA expectations as discussed during previous project teleconferences.

Surface sediments (0 to 4 inch sampling depth) will be collected from each of the 30 sampling locations. Each sample will represent a localized station composite of five equal volume aliquots. One aliquot will be collected at the target location and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass. Sediments will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into sample containers as listed in Table A-2.

During sampling, additional surface or subsurface sediment samples may be collected for archiving and/or for contingent chemical analysis under the following conditions:

- Additional Surface Sample Locations: If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.
- Subsurface Sampling: If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Subsurface samples will be collected from discrete locations where hydrocarbon sheen or odor is noted. If hydrocarbon sheen or odor are noted in more than one sample aliquot location, the subsurface aliquots containing the sheen or odor will be composited.

If contingent surface or subsurface sediment samples are collected and archived as described above, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed, these will be analyzed using the same analysis methods used for analysis of the 30 planned surface sediment samples (Figure A-2).

## 3.2 Horizontal Positioning for Sediment Sampling

Horizontal positioning at each sample location will be determined using a differential global positioning system (DGPS) with a handheld GPS unit. Horizontal geographical coordinates will be in the North American Datum (NAD) 83, Washington State Plane, North Zone and use international feet.

## 3.3 Field Quality Assurance/Quality Control Samples

Field QA/QC field duplicate and rinse blank samples will be collected and used to evaluate the variability resulting from sample handling and the efficiency of field decontamination procedures. All field QA/QC samples will be documented in the Site logbook and on the field forms (Section 3.5).

### *3.3.1 Field Duplicates*

Field duplicates are used to assess homogenization techniques. The field duplicates will be prepared by dividing aliquots of the field sample homogenate into two distinct samples for analysis at the laboratory: the field sample and a duplicate. The duplicate samples will be processed in exactly the same way as the field samples and will be submitted to the laboratory as blind duplicates. Duplicates will be collected at a rate of one per 20 field samples collected for analysis and analyzed for the same parameters as the field samples. Field duplicate sample identification is described in Section 3.4.1.

### *3.3.2 Rinse Blanks*

Rinse blank samples will be collected to evaluate the efficiency of field decontamination procedures. One rinse blank will be collected for each type of sampling technique utilized. The rinse blank will consist of rinsing homogenization equipment after sample collection and decontamination with distilled water and collecting the rinsate for analysis. The rinse blank samples will be collected at a rate of one per sampling event and will be analyzed for PAHs. The rinse blank sample identification schematic is described in Section 3.4.1.

## 3.4 Station and Sample Identification for Sediment Sampling

Each sediment sample will be assigned a unique alphanumeric identifier according to the method described below. The identifiers facilitate sample tracking by incorporating identifying information.

The alphanumeric identifiers will be assigned in the following manner for sediments:

- The first three characters identify the sample location by the project descriptor: BGW for Bremerton Gas Works.
- The next two characters identify the sampling event: RE for Removal Evaluation.
- The next 2 characters identify the sampling matrix: SG for Sediment Grab.
- The next two characters identify the sample station: -01 = Station 01.
- The next six characters identify the collection date: -YYMMDD.

For example, sample number BGW-RE-SG-01-100101 indicates a Removal Evaluation sediment grab sample obtained from Station 01 on January 01, 2010. The representative depths for each sampling interval will be defined in the field logs and provided in the chemical analytical results tables.

The field QA QC samples will be assigned a unique alphanumeric identifier according to the method described below:

- The first seven characters will be BGW-RE-SG.
- The rinsate blank samples will be followed with a -RB followed by the date in YYMMDD format.
- The field duplicate will be followed with –XXSE-A-YYMMDD (sediments) or –XXSO-A-YYMMDD (soils) where XX is the station number plus 50, A is the sampling interval, and YYMMDD is the sampling date.

For example, sample number BGW-RE-SG-RB-100105 and BGW-RE-SG-51SE-A-100105 represent a rinsate blank (field blank) collected on January 5, 2010 and a homogenization duplicate sediment sample collected from station 01 interval A on January 5, 2010, respectively.

When necessary, extra sample volume collected for matrix spike/matrix spike duplicate (MS/MSD) analysis will be identified with the same designation as the sample. This may be the case when sample material for additional analyses, as determined in consultation with EPA, are needed.

## 3.5 Field Documentation

A complete record of all field activities will be maintained including the following:

- Documentation of all field activities on appropriate field forms, including:
  - Daily Log
  - Tailgate Health and Safety Form
  - Incident Report
- Documentation of all samples collected for analysis, including :
  - Surface Sediment Collection Log
  - Chain-of-custody

The FC or a designee will maintain the field forms. All on-Site activities, including health and safety entries and field observations will be documented on the Daily Log Form. All entries will be made in indelible ink. The Daily Log is intended to provide sufficient data and observations to enable readers to reconstruct events that occurred during sample collection. The Daily Log will include clear information concerning any modifications to the details and procedures identified in this FSP. The tailgate Health and Safety Form is intended to document start-of-day health and safety orientation meetings.  The incident report form is intended to document any health and safety reportable incidences.  Surface sediment collection forms will be completed for each sampling station.

Field data sheets will be maintained as samples are collected, and will be referenced to the sample station location map.  The following information will be included in the Surface Sediment Collection Log forms:

- Date and time of collection of each sample.
- Names person(s) collecting and logging the sample.
- Sample matrix description.
- Observations made during sample collection including: weather conditions, complications, and any other details associated with the sampling effort.
- Sample station number.
- Any deviation from the approved FSP.

Chain-of-custody forms will be updated as sample jars are filled and labeled at each station.

## 3.6 Sample Handling

This section describes the sample handling and storage, sample containers, decontamination procedures, chain-of-custody forms, and sample transport for all sample collection activities.

### *3.6.1 General Sample Handling and Storage*

The guidelines for sample handling and storage for collected field and QA/QC samples are provided in Table A-2.  Sample collection and homogenization equipment, containers, and any other items that may come into contact with sample material must meet high standards of cleanliness.  All equipment used during sample collection will be made of glass, stainless steel, or polytetrafluoroethylene (PTFE), and will be decontaminated prior to each day's use and between sampling or homogenization events.

All working surfaces and instruments will be thoroughly decontaminated following the protocols in Section 3.6.3, and covered with aluminum foil to minimize outside contamination between sample collection events.  Disposable gloves will be discarded after processing each station and replaced prior to handling decontaminated equipment or work surfaces.  Collected samples will be stored in coolers with ice prior to delivery to the laboratory.

### *3.6.2 Sample Containers*

All sample containers received from the analytical lab will be pre-cleaned and certified. Required sample container types are listed in Table A-2.  Prior to filling, each container will be clearly labeled with the name of the project, sample number, type of analysis, date, time, and initials of the person preparing the sample.

### 3.6.3 Field Equipment Decontamination

To prevent sample cross contamination, sampling and processing equipment in contact with the samples will undergo the following decontamination procedures prior to and between collection activities in accordance with EPA protocols (EPA 2001). Between sample collection activities, all sample collection and homgenization equipment that will come in contact with the sample will be decontaminated prior to use by the following procedure:

- Rinse with Site or potable water and wash with scrub brush until free of sediment.
- Wash with phosphate-free detergent (e.g., Alconox®).
- Visually inspect the equipment and repeat the scrub and rinse step, if necessary.
- Rinse with potable water.
- Rinse with deionized water three times.

### 3.6.4 Sample Transport and Chain-of-Custody Procedures

All containerized sediment samples will be delivered to the designated analytical laboratories daily by hand or by courier after preparation is completed. Specific sample shipping procedures will be as follows:

- Individual sample containers will be placed in sealable plastic bags, packed to prevent breakage and transported in a cooler.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- Ice will be placed in the cooler to maintain a storage temperature of approximately 4 degrees Celsius (°C).
- Chain-of-custody forms will be enclosed in a plastic bag and placed in the cooler.
- If couriered or shipped, the cooler lids will be secured by wrapping the coolers in strapping tape and chain of custody seals will be placed on cooler lids

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample containers will sign the chain-of-custody forms. Upon receipt, the laboratory receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody forms. Chain-of-custody forms will be used internally in the lab to track sample handling and final disposition.

# 4 Drainage System Inspection

A field survey will be conducted to evaluate the potential for stormwater to enter the drainage system leading to the pipe that was plugged during the November 2010 TCRA. As described in the Work Plan, the plugged pipe may be connected to a manhole located on the Sesko Property that is filled with debris. Sewer records indicate some of the pipes leading to that manhole have been abandoned, but the status of two of those pipes is unknown.

The Drainage System Inspection will include the following:

- Remove debris from the top of the manhole if possible using hand equipment, to further inspect the interior of the manhole and potential inlets. All work will be conducted from the surface and no entry will be made into the manholes.
- Inspect surface topography and ground surface conditions around the manhole, including identification of potential surface water drainage pathways, to evaluate the potential for stormwater to flow into the manhole during rain events.
- Perform field reconnaissance in the area located to the northwest of Manhole "A" to evaluate for the presence of any catch basins. Any catch basins that are located will be surveyed using a field GPS and inspected to estimate pipe alignments.
- Perform field reconnaissance in the area located to the south of Manhole "A", including the former tank farm located on the Sesko Property, to evaluate the presence of catch basins or other drainage pipe inlets that may lead to Manhole "A."

If any piping is identified that may connect to Manhole "A", a private utility locating service will be contacted to identify the location and depth of pipe and, if possible, perform a TV camera inspection to evaluate condition and contents.

# 5 Bluff Inspection and Contingent Sampling

Inspection and contingent sampling will be conducted along the boundary between the upland properties ("the bluff") and the beach to evaluate whether there is an exposed contaminant migration pathway from the upland area to the sediment and/or surface water of Port Washington Narrows through either the erosion of bluff soil or direct discharge of hydrocarbon product.

The bluff inspection area will extend west to east from approximately the Thompson Avenue right-of-way to the Pennsylvania Avenue right-of-way. The inspection will include the soils at the base of the bluff. A photoionization detector (PID) or flame ionization detector (FID) will also be used to help detect the presence of hydrocarbon vapors.

The bluff inspection will consist of the following:

- Observing exposed soils in the lower bluff area.
- Inspect and document any evidence of hydrocarbon staining, hydrocarbon odors, or seeps containing potential hydrocarbon sheen or product.
- Collect and archive samples of bluff soil where observed to contain hydrocarbon staining, sheen, or odors.
- Collected and archive samples of liquid seeps (if feasible) where observed to contain potential hydrocarbon sheen or product.
- If contingent soil or seep liquid samples are collected and archived, these archive samples will be discussed with EPA. Some of these archived samples may be subjected to chemical analysis if directed by EPA. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned surface sediment samples as described in Section 3.1. Table A-4 provides a summary of contingent bluff soil or seep liquid samples

Each opportunistic bluff sample will be assigned a unique alphanumeric identifier according to the method described below. The identifiers facilitate sample tracking by incorporating identifying information. The alphanumeric identifiers will be assigned in the manner below.

The alphanumeric identifiers will be assigned in the following manner for sediments:

- The first three characters identify the sample location by the project descriptor: BGW for Bremerton Gas Works.
- The next two characters identify the sampling event: RE for Removal Evaluation.
- The next 2 characters identify the sampling matrix: BS for Bluff Sample.
  - The next two characters identify the sample station: -01 = Station 01.

- The next six characters identify the collection date: -YYMMDD.

Opportunistic sample locations will be determined by DGPS and coordinates recorded on the field sampling forms.

# 6 Chemical Testing

Sediment and soil chemical and physical testing will be conducted at Analytical Resources, Inc. (ARI) located in Tukwila, Washington. ARI is accredited under the National Environmental Laboratories Accreditation Program (NELAP). All chemical and physical testing will adhere to SW-846 QA/QC procedures and analysis protocols (EPA 1986) or follow the appropriate Standard Method or PSEP protocols. If more current analytical methods are available, the laboratory may use them.

All sample analyses will be conducted in accordance with EPA-approved methods and the QAPP. Key elements of the QAPP relevant to field sample collection and analysis include the following:

- Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis as outlined in the QAPP.
- Field personnel are responsible for providing the rinseate blanks and field duplicates defined in this FSP.
- Proposed analytes, analytical methods, and target reporting limits for the chemical testing are defined in the QAPP.
- The analytical laboratories will prepare a detailed report in accordance with the QAPP. Prior to the chemical analysis of the samples, the laboratories will calculate method detection limits (MDLs) for each analyte of interest, where applicable. Quantitation limits (QLs) typically correspond to the lowest level of calibration and are three to ten times higher than MDLs. QLs will be below the values specified in the QAPP if technically feasible and detected results will be reported down to the MDLs. Results between the MDLs and QLs will be flagged as estimated by the laboratory.
- Method reporting limits will be below the values specified in the QAPP, if technically feasible. These reporting limits may not be achieved in the event that constituent concentrations are elevated or if there are matrix interferences. If specified reporting limits are not achieved, possible corrective actions will be discussed with the laboratory and with EPA. If analytical methodology modifications are to be used to address raised reporting limits, these will be presented to EPA for review and approval prior to implementation.

# 7 Field Sampling Schedule

Field sampling will be performed as soon as practicable after EPA approval of the Work Plan, including this FSP and the attached QAPP. If practicable, and depending on the schedule for EPA review and comment, field sampling will be performed during the daytime low tides of summer 2013. The proposed sampling dates will be confirmed with EPA after receipt of EPA review comments and/or approval of the Work Plan, FSP, and QAPP.

All removal evaluation activities will comply with the schedule defined in the AOC and SOW, unless an alternative schedule is approved by EPA. These activities as defined in the SOW include, but are not limited to, development of the final Removal Evaluation Work Plan and development of the final Removal Evaluation Report.

# 8 References

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition. EPA SW-846, 1986.

EPA. 2001. Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA/823/B-01-022, October 2001.

# TABLES

## Table A-1
## Project Personnel and Subcontractors

| Name | Organization | Project Title | Project Role | Mailing Address | Email Address | Office Phone | Cell Phone |
|---|---|---|---|---|---|---|---|
| **Representatives** | | | | | | | |
| Kalle Godel | Cascade Natural Gas | | Site representative | 400 N 4th Street, Bismark, North Dakota 58501 | Kalle.Godel@mdu.com | (701) 222-7657 | (701) 471-0927 |
| **Consultants** | | | | | | | |
| Jeremy Porter | Aspect Consulting | Project Manager | Aspect project manager | 401 2nd Avenue South, #201 Seattle, Washington 98104 | jporter@aspectconsulting.com | (206) 838-5835 | (206) 790-2129 |
| Carla Brock | Aspect Consulting | Task Manager - Upland Investigation | Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met. | 401 2nd Avenue South, #201 Seattle, Washington 98104 | cbrock@aspectconsulting.com | (206) 838-6593 | (425) 269-7255 |
| Mark Larsen | Anchor QEA | Project Manager | Anchor QEA project manager | 1119 Pacific Avenue, Suite 1600 Tacoma, Washington 98402 | mlarsen@anchoroqea.com | (206) 903-3359 | (206) 310-2263 |
| Ed Berschinski | Anchor QEA | Project Technical Advisor | Anchor QEA technical advisor regarding removal evaluation | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | eberschiniski@anchorqea.com | (206) 903-3315 | (206) 819-6099 |
| David Templeton | Anchor QEA | Project Health and Safety Manager | Anchor QEA health and safety manager | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | dtempleton@anchorqea.com | (206) 903-3312 | (206) 910-4279 |
| Dan Hennessy | Anchor QEA | Task Manager - Sediment Investigation | Initial coordination of field and laboratory activities; ensures all field sampling and handling procedures are followed and documented, and that field QA objectives are met. | 1605 Cornwall Avenue Bellingham, Washington 98225-4427 | dhennessy@anchorqea.com | (360) 733-4311 | (206) 491-0610 |
| Nathan Soccorsy | Anchor QEA | Field Safety Officer/Coordinator | Reports to the Task Manager. Ensures all project health and safety requirements are followed; coordinates and participates in the field sampling activities; coordinates sample deliveries to lab; coordinates sampling activities with site owner and subcontractors; report to the Task Manager any deviations from the project plans. | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | nsoccorsy@anchorqea.com | (206) 903-3385 | (480) 272-2805 |
| Delaney Peterson | Anchor QEA | Project QA Manager | Coordinates with laboratory to ensure that SQAPP requirements are followed and that laboratory QA objectives are met. | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | dpeterson@anchorqea.com | (206) 903-3396 | (206) 919-2845 |
| Laurel Menoche | Anchor QEA | Project Data Manager | Ensures that anaytical data is incorporated into site dabase with appropriate qualifiers following validation | 720 Olive Way, Suite 1900 Seattle, Washington 98101 | lmenoche@anchorqea.com | (206) 903-3372 | |
| **Environmental Protection Agency (EPA)** | | | | | | | |
| William Ryan | EPA | EPA Remedial Project Manager | Overall project management | 1200 6th Ave Suite 900 ECL-113 Seattle, Washington 98101 | ryan.william@epa.gov | (206) 553-8561 | |
| Kathy Parker | EPA | EPA On Scene Coordinator | Coordinate with EPA RPM on topic realated to Removal Evaluation and implementation of early actions at the Site | 1200 6th Ave Suite 900 ECL-116 Seattle, Washington 98101 | parker.kathy@epa.gov | (206) 553-0062 | (206) 321-3796 |
| Ginna Grepo-Grove | EPA | EPA Region 10 QA Manager | RI/FS technical support QA/QC issues | 1200 6th Ave Suite 900 OEA-95 Seattle, Washington 98101 | Grepo-Grove.Gina@epamail.epa.gov | (206) 553-1632 | |
| **Subcontractors** | | | | | | | |
| Cheronne Oreiro | Analytical Resources, Inc. | Laboratory Manager | Soil and sediment analysis | 4611 South 134th Place , Suite 100 Tukwila, Washington 98168 | Cheronneo@arilabs.com | (206) 695-6214 | |

## Table A-2
## Container Size, Holding Time, and Preservation for Physical/Chemical Analyses

| Parameter | Sample Size | Container Size and Type | Holding Time | Preservative |
|---|---|---|---|---|
| Polycyclic aromatic hydrocarbons | 100 g | 8-oz glass | 14 days until extraction | Cool/4$^{o}$ C |
| | | | 1 year until extraction | Freeze -20° C |
| | | | 40 days after extraction | Cool/4$^{o}$ C |
| Total solids | 25 g | 4-oz glass | 14 days | Cool/4$^{o}$ C |
| | | | 6 months | Freeze -20° C |
| Total organic carbon | 25 g | | 14 days | Cool/4$^{o}$ C |
| | | | 6 months | Freeze -20° C |

Notes:
C = Celsius
g = gram
oz = ounce

## Table A-3
## Proposed Removal Evaluation Surface Sediment Explorations

| Station ID | Sample Collection Method | Depth Interval | Media | Sampling DQO[2] | Analytical Chemistry | Coordinates[3] Northing (Y) | Easting (X) |
|---|---|---|---|---|---|---|---|
| **Removal Evaluation Intertidal Beach Surface Sediment Sampling [1]** | | | | | | | |
| BGW-RE-SG-01 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216322.04 | 1193634.86 |
| BGW-RE-SG-02 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216356.85 | 1193634.86 |
| BGW-RE-SG-03 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216388.50 | 1193635.20 |
| BGW-RE-SG-04 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216308.24 | 1193734.86 |
| BGW-RE-SG-05 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216343.50 | 1193734.86 |
| BGW-RE-SG-06 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216379.86 | 1193734.86 |
| BGW-RE-SG-07 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216304.94 | 1193834.86 |
| BGW-RE-SG-08 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216330.55 | 1193834.86 |
| BGW-RE-SG-09 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216357.04 | 1193834.86 |
| BGW-RE-SG-10 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216293.40 | 1193912.72 |
| BGW-RE-SG-11 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216323.54 | 1193918.27 |
| BGW-RE-SG-12 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216279.67 | 1193934.86 |
| BGW-RE-SG-13 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216312.36 | 1193945.00 |
| BGW-RE-SG-14 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216244.75 | 1193934.86 |
| BGW-RE-SG-15 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216281.23 | 1193957.16 |
| BGW-RE-SG-16 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216307.60 | 1193965.51 |
| BGW-RE-SG-17 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216227.43 | 1193953.99 |
| BGW-RE-SG-18 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216200.00 | 1193967.25 |
| BGW-RE-SG-19 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216218.60 | 1193979.11 |
| BGW-RE-SG-20 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216285.77 | 1194021.95 |
| BGW-RE-SG-21 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216198.47 | 1194007.68 |
| BGW-RE-SG-22 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216230.19 | 1194027.96 |
| BGW-RE-SG-23 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216286.01 | 1194041.83 |
| BGW-RE-SG-24 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216203.04 | 1194034.86 |
| BGW-RE-SG-25 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216235.69 | 1194050.42 |
| BGW-RE-SG-26 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216275.79 | 1194064.71 |
| BGW-RE-SG-27 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216234.33 | 1194080.61 |

## Table A-3
## Proposed Removal Evaluation Surface Sediment Explorations

| Station ID | Sample Collection Method | Depth Interval | Media | Sampling DQO[2] | Analytical Chemistry | Coordinates[3] Northing (Y) | Coordinates[3] Easting (X) |
|---|---|---|---|---|---|---|---|
| BGW-RE-SG-28 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216201.65 | 1194134.94 |
| BGW-RE-SG-29 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216225.63 | 1194134.94 |
| BGW-RE-SG-30 | Hand collection with stainless steel trowel | 0-4 in. | Bulk Sediment | Assess nature and extent of surface contamination | SIM-PAH, TOC, Archive | 216248.75 | 1194135.08 |
| BGW-RE-SG-XX (Field duplicate 1) | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess sample variability and the nature and extent of surface contamination | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-SG-XX (Field duplicate 2) | Hand collection with stainless steel trowel | 0-4 in | Bulk Sediment | Assess sample variability and the nature and extent of surface contamination | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-SG-RB | Rinse blank | N/A | Distilled water | Assess equipment decontamination procedures | SIM-PAH | N/A | N/A |

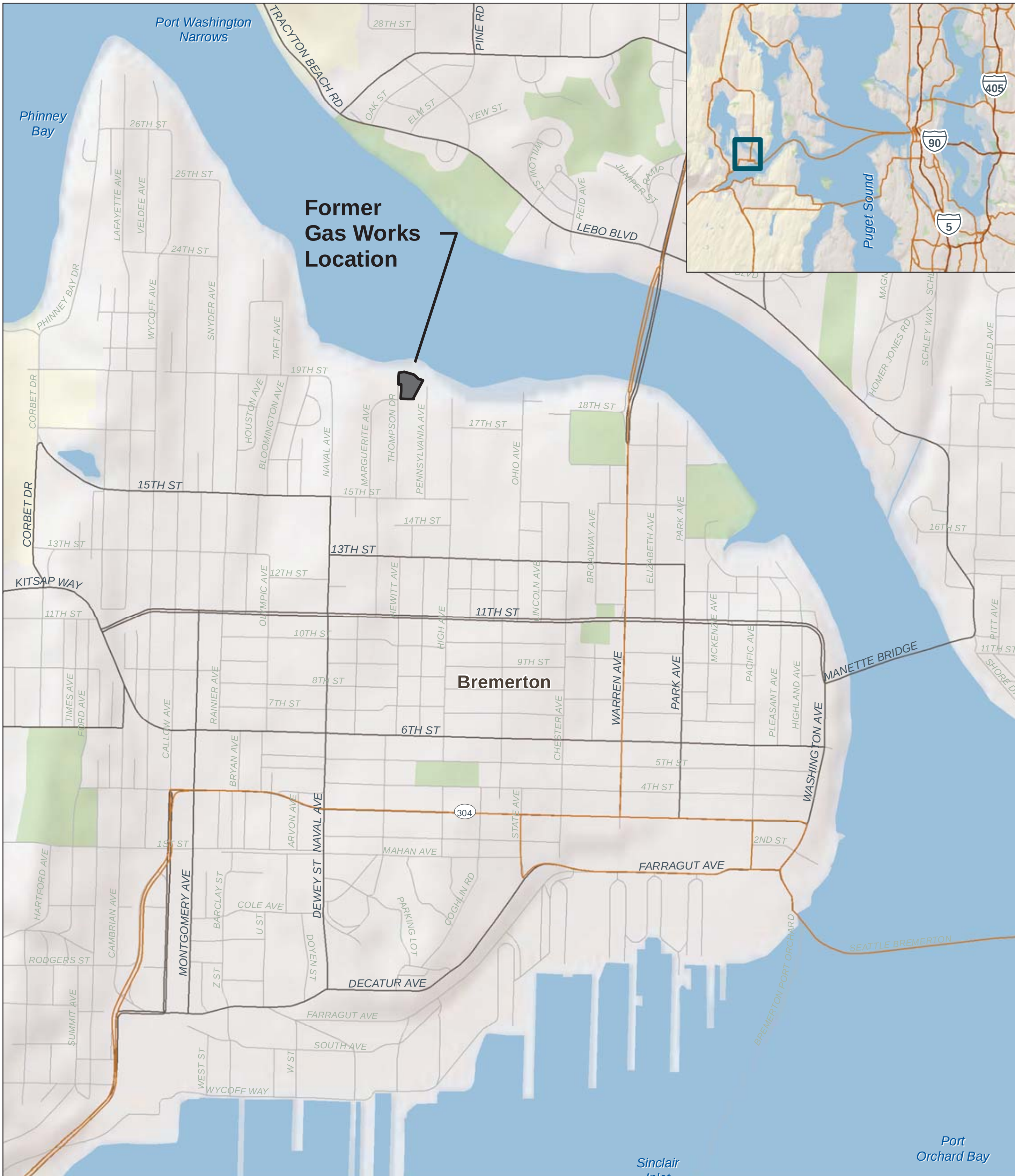
Notes
1 = If hydrocarbon sheen or odor is observed in during bulk sediment sampling, an additional opportunistic sample from the 4 to 12 inch interval will be collected and archived. The decision to analyze the opportunistic sample will be made in consultation with Environmental Protection Agency (EPA).
2 = Each station sample will consist of five equal volume aliquots. One aliquot will be collected at the target location, and the other four aliquots will be collected approximately three feet from the target location at the approximate four points of the compass.
3 = Washington State Plane North, North American Datum 83, U.S. feet
BGW = Bremerton Gas Works
DQO = data quality objective
in. = inch
RE = removal evaluation
SG = sediment grab
SIM PAH = selective ion monitoring polycyclic aromatic hydrocarbon (PAH). High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC = total organic carbon

**Table A-4**
**Removal Evaluation Contingent Bluff Soil or Seep Liquid Samples**

| Sample ID | Sample Collection Method | Depth Interval | Media | Sampling DQO | Analytical Chemistry | Coordinates[1] | |
|---|---|---|---|---|---|---|---|
| | | | | | | Northing (Y) | Easting (X) |
| **Contingent Soil or Seep Liquid Sampling** | | | | | | | |
| BGW-RE-BS-01 | Hand collection with stainless steel trowel | TBD | Soil | Assess nature of contamination from bluff soil | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-BS-02 | Direct collection | N/A | Liquid | Assess nature of contamination from seep liquid | Archive | TBD | TBD |
| BGW-RE-BS-XX (Field duplicate) | Hand collection with stainless steel trowel | TBD | Soil | Assess sample variability and nature of contamination from bluff soil | SIM-PAH, TOC, Archive | TBD | TBD |
| BGW-RE-BS-RB | Rinse blank | N/A | Distilled water | Assess equipment decontamination procedures | SIM-PAH | N/A | N/A |

Notes
1: Washington State Plane North, NAD 83, US feet.
DQO - Data Quality Objective
SIM PAH - Selective Ion Monitoring Polycyclic Aromatic Hydrocarbon. High resolution analytical method (EPA 8270D-SIM) for detemination of PAH concentrations at low concentrations.
TOC - Total Organic Carbon
BGW - Bremerton Gas Works
RE - Removal Evaluation
BS - Bluff Sample
TBD - To be determined
N/A - Not applicable

# FIGURES




AQ GIS Path: Q:\Jobs\100719-01_Bremerton_MGP\Maps\2013_06\Vicinity_Map Work Plan and SQAPP (Aspect Template).mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/7/2013 || User: dhennessy || Print Date: 6/11/2013

N

0 750 1,500

Feet

1:18,000

**NOTE:**
If a paper copy is required, this figure is best printed in color.

# Former Gas Works Location and Vicinity
# Removal Evaluation Work Plan

Bremerton Gasworks
Bremerton, Washington

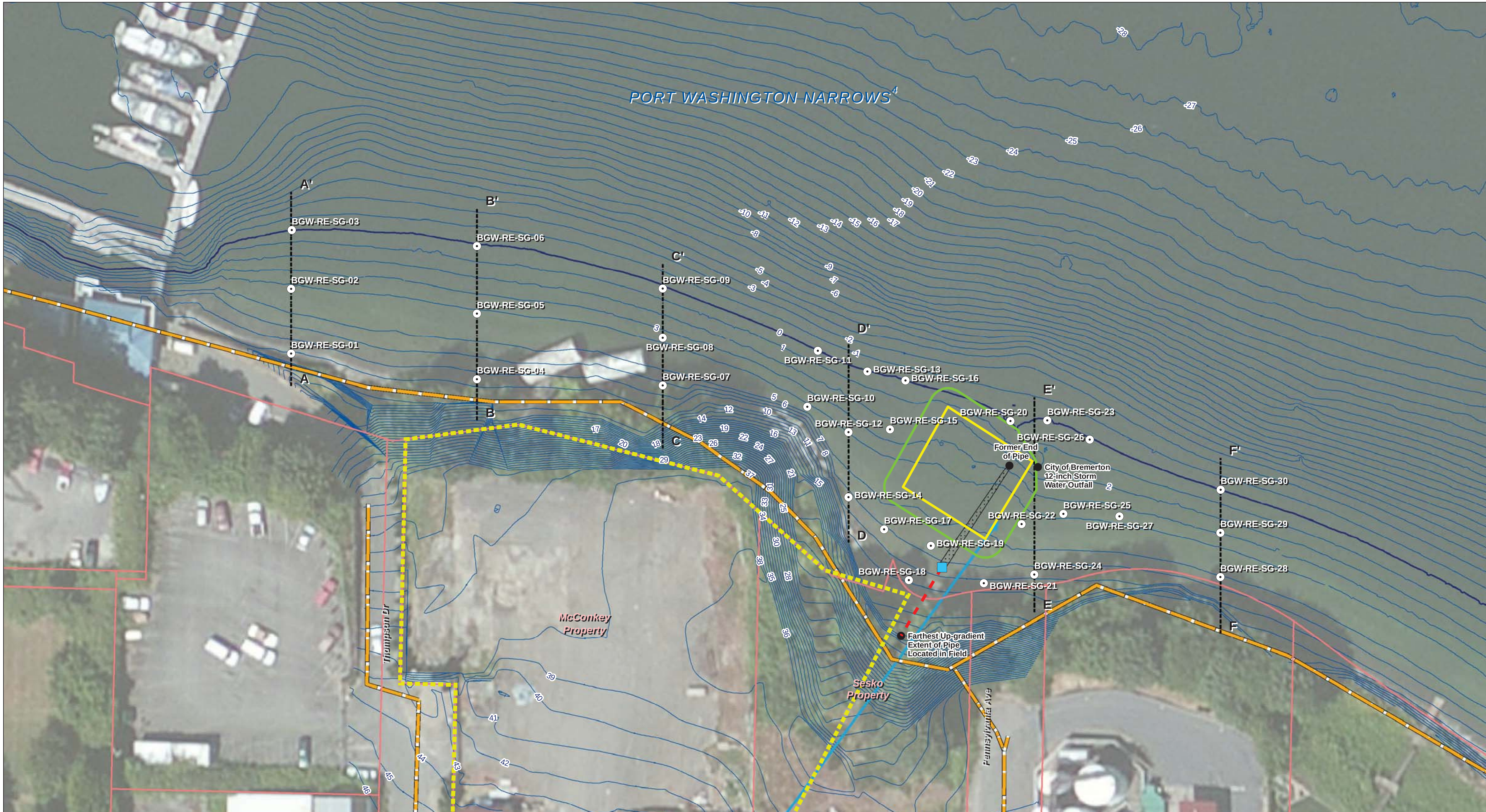
Aspect CONSULTING

ANCHOR QEA

FIRM: ANCHOR QEA

DRAWN BY: dhennessy

FIGURE NO. **A-1**




- Field Verified Pipe Location
- TCRA/IA Pipe Plug Location[2]
- Remaining 12-inch Concrete Pipe[2]
- Pipe Removed and Backfilled to Grade[2]
- Cover of Organo-Clay Mat (10-inch minus rock)[2]
- Extent of Organo-Clay Mat[2]
- Proposed Sampling Locations
- 100-Foot Transects
- Sanitary Sewer
- Storm Sewer
- Bathymetry/Topography Contours (MLLW ft)[1]
- Former Gas Works Location
- Parcel Boundaries[3]

**NOTES:**
1. Survey conducted by eTrac; provided on May 15, 2013.
2. See Final Completion Report, Former Bremerton MGP Site, Incident Action and Time Critical Removal Action, January, 2011. Locations are approximate.
3. Acquired from Kitsap County GIS Data Download (http://www.kitsapgov.com/gis/metadata) and Real Property Search Tools (http://kcwppub3.co.kitsap.wa.us/ParcelSearch), May 15, 2013. Locations are presumed to be approximate.
4. State Aquatic Lands - Managed by DNR
5. 0-ft contour = Mean Lower Low Water (MLLW)
6. If a paper copy is required, this figure is best printed in color.

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*1:600*

**Removal Evaluation Intertidal Sampling Locations**
**Removal Evaluation Work Plan**
Bremerton Gasworks
Bremerton, Washington

Aspect CONSULTING
ANCHOR QEA

FIRM: ANCHOR QEA
DRAWN BY: dhennessy

FIGURE NO. **A-2**

# ATTACHMENT A-1

# Field Forms

# Daily Log

Anchor QEA L.L.C.
720 Olive Way, Suite 1900
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

**PROJECT NAME: Bremerton Gasworks** **DATE:**

**SITE ADDRESS:** **PERSONNEL:**

| **WEATHER:** | **WIND FROM:** | N | NE | E | SE | S | SW | W | NW | LIGHT | MEDIUM | HEAVY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SUNNY | | CLOUDY | | RAIN | | | ? | **TEMPERATURE:** | ° F . | ° C |

[Circle appropriate units]

| **TIME** | **COMMENTS** |
|---|---|
| See Field Logs for detailed logging and sampling | |
| Equipment on site: | |
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Notes: Work performed, Phone calls made, Problems Issues/Resolutions, Visitors on site
Safety infractions, Important comments/instructions to contractors

Signature: ______________________

ANCHOR QEA

DATE: ____________

PROJECT NAME: Bremerton Gasworks

PROJECT NO: 131014-01.01

# DAILY SAFETY BRIEFING

**PERSON CONDUCTING MEETING:** ____________ **HEALTH & SAFETY OFFICER:** ____________ **PROJECT MANAGER:** ____________

**TOPICS COVERED:**

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Other:
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking

**WEATHER CONDITIONS:** ____________

**DAILY WORK SCOPE:** ____________

**SITE-SPECIFIC HAZARDS:** ____________

**SAFETY COMMENTS:** ____________

**ATTENDEES**

| PRINTED NAME | SIGNATURE |
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# EMPLOYEE EXPOSURE/INJURY INCIDENT/SPILL REPORT

**EMPLOYEE NAME:** ______________________ **DATE:** ______________

**PROJECT NAME/NO:** Bremerton Gasworks/131014-01.01 **TIME:** ______________

**TYPE OF OCCURRENCE:** ☐ employee exposure ☐ injury incident ☐ spill

**SITE NAME AND LOCATION:** ______________________

**SITE WEATHER (clear, rain, snow, etc.):** ______________________

**NATURE OF ILLNESS/INJURY:** ______________________

**SYMPTOMS:** ______________________

**ACTION TAKEN:** ☐ rest ☐ first aid ☐ medical

**TRANSPORTED BY:** ______________________

**WITNESSED BY:** ______________________

**HOSPITAL NAME:** ______________ **TREATMENT:** ______________

**DESCRIBE IN DETAIL HOW THIS EXPOSURE/INJURY INCIDENT/SPILL OCCURRED**
**(if a spill, list the name of the compounds, quantities, and method of clean-up/containment):** ______________

**WHAT WAS THE PERSON DOING AT THE TIME OF THE ACCIDENT/INCIDENT?:** ______________

**LIST PERSONAL PROTECTIVE EQUIPMENT WORN:** ______________

**WHAT IMMEDIATE ACTION WAS TAKEN TO PREVENT RECURRENCE?:** ______________

*Employee:*

| Printed Name | Signature | Date |
|---|---|---|

*Supervisor:*

| Printed Name | Signature | Date |
|---|---|---|

*Site Safety Representative:*

| Printed Name | Signature | Date |
|---|---|---|

***NOTE: Use additional page(s) if necessary.***

**Chain of Custody Record & Laboratory Analysis Request**

Laboratory Number:

Date:
Project Name: Bremerton Gasworks
Project Number: 131014-01.01
Project Manager:
Phone Number:
Shipment Method:

| Line | Field Sample ID | Collection Date/Time | Matrix | No. of Containers | Test Parameters | | | | | | | | | | | | | | | | | | Comments/Preservation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | |
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| 14 | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | |

Notes:

| Relinquished By: | Company: Anchor QEA, LLC | Received By: | Company: |
|---|---|---|---|
| Signature/Printed Name | Date/Time | Signature/Printed Name | Date/Time |

| Relinquished By: | Company: | Received By: | Company: |
|---|---|---|---|
| Signature/Printed Name | Date/Time | Signature/Printed Name | Date/Time |

*Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.*

ANCHOR QEA

# Surface Sediment Field Log

Job: Bremerton Gasworks — Station:

Job No: 131014-01.01 — Date:

Field Staff: — Sample Method: Hand Collection

Proposed Coordinates:

Tide Measurements — Horizontal Datum: — Easting:

Northing:

Time:

Height:

Notes: Mudline Elevation (lower low water-large tides): calculated after sampling

| Grab # | Time | Confirmed Coordinates (datum) | | Sample Accept (Y/N) | Recovery Depth (in) | Comments |
|---|---|---|---|---|---|---|
| | | WGS 84 (N) | WGS 84 (E) | | | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |

**Sample Description:**

Sample Containers:

Analyses:

# Bremerton Gasworks – Physical Description of Sediment Key

**Visual Sediment Descriptions consist of the following:**

MAJOR CONSTITUENT GROUP NAME. Moisture content, density/consistency, color, major constituent (%), minor constituents (%), plasticity. Amount and shape of minor constituents (e.g., wood, shells). Biota. Sheen, odor (as needed). Structure descriptions (as needed). Use parenthesis to denote interpretation (e.g., asphalt, glass).

**Examples:**

SILT with SAND (MH) Moist, soft, olive gray, 80% fines, 20% f-sand, medium plasticity, contains fine gravel and anthropogenics (brick and plastic fragments), sulfide odor.

CLAYEY GRAVEL with SAND (GC) Moist, dense, dark brown, 70% f-c gravel, 15% m-sand, 15% low plasticity fines, gravel is subrounded up to 3".

## Sediment Description Terminology

| **MAJOR and minor Group Name** | | | |
|---|---|---|---|
| Gravel | Sand | Silt | Clay |
| ** For Group Name of Major Unit follow flow charts in ASTM D2488. Incorporate use of terms 'Lean, Sandy, Gravelly, Fat, Elastic'* | | | |
| ** MAJOR is written in all CAPITAL LETTERS (i.e., SILTY SAND), If minor sand/gravel constituents >15% use 'with GRAVEL' or 'with SAND'* | | | |

| **Moisture Content** | |
|---|---|
| Dry | Little perceptible moisture (upland only), dusty or powdery |
| Wet | Visible free water |
| Moist | No visible water (most sediment) |

| **Density/Consistency** | |
|---|---|
| **SILT or CLAY** | |
| ***Consistency:*** | ***Notes:*** |
| Very soft | Soupy |
| Soft | Easily penetrated, just starting to be cohesive |
| Firm | Molded by figure pressure |
| Hard | Can indent and mold by finger pressure |
| Very Hard | modeling clay (rolls to a ball) |

| **Color and Shading** | | | |
|---|---|---|---|
| ***Example Colors:*** | Black | Browns (olive, yellow, red) | Grays (gray, olive brown) |
| ***Shades:*** | Light | Dark | Very Dark |

| **Descriptors* – Sand and Gravel** | | | |
|---|---|---|---|
| Grain size | Sand: fine, medium, coarse (no "vf" or "vc") | Gravel: fine (0.19-0.75") and coarse (0.75-3") | Cobbles: >3" |
| Grading | Well graded: many sizes | Poorly graded: homogenous | |
| Grain color | (black, white, grey, yellow, etc.) | *(*State percentage of fines, gravel, and sand either in text or in columns provided on log.)* | |
| Rounding | (subrounded, subangular, angular, rounded) | | |

| **Plasticity** | |
|---|---|
| Non-plastic, low, medium, high | **For fine-grained soil, describe plasticity of the unit after grain size percentages (...80% fines, 20% sand, low plasticity)*<br>**For coarse grained soil, describe the plasticity of the fines as part of the percentage description (…80% medium sand, 20% low plasticity fines)* |

| **Other Minor Constituents: % volume** *(anthropogenics, etc.)* | | |
|---|---|---|
| ***Other Minor Constituents*:*** | Anthropogenics (aggregates, trash) | Organics (wood debris, fresh/decomposed) |
| ***Percent:*** | Call out volume in 5% increments | |

| **Biota** |
|---|
| Marsh grass, peat, worms, shells, etc. |

| **Odor Descriptions*** *(*use the following descriptors: none, slight, and strong)* | | |
|---|---|---|
| Hydrocarbon-like | $H_2S$ - like (Hydrogen sulfide - like) | Septic - like |

| **Product** | |
|---|---|
| Hydrocarbon Stained | Visible brown or black stains (fine grained) |
| Hydrocarbon Coated | Visible brown or black coating (coarse grained) |
| Hydrocarbon Wetted | Visible brown or black hydrocarbon wetting on soil. Hydrocarbon appears as a liquid and is not held by soil grains (pools) |

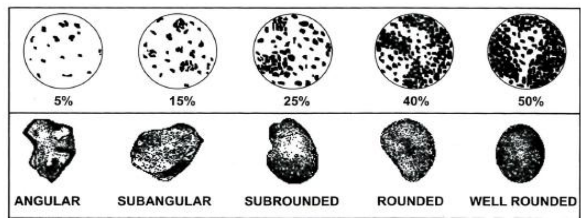
| **Sheen** | |
|---|---|
| Describe sheen as necessary with percentages (5% increments) | **No odor or sheen observed unless noted* |
| ***Visual Description Terminology:*** | |
| Rainbow | Multicolored |

# Bremerton Gasworks – Physical Description of Sediment Key

| | |
|---|---|
| Metallic | Metallic gray-colored |
| Florets | Semi-circular and flat (2-D) |
| Blebs | Semi-circular and spherical (3-D) |
| **Structure and Other Sediment Descriptions** | |
| Blocky | Cohesive soil that can be broken down into smaller lumps |
| Decomposed | Visible sign of decomposition or discoloration |
| Fresh | No visible sign of decomposition or discoloration |
| Gummy | Cohesive, pliable soil with high percentage of clay |
| Bed | Greater than 1/2" thick |
| Thin bed | Up to 1/2" thick |
| Laminated beds | Thin beds (<1/2" thick) lying between or alternating within a greater unit |
| Stratified beds | Beds (>1/2" thick) lying between or alternating within a greater unit |
| Layer | A bed or thin bed of anthropogenic material |
| Pockets | Semicircular to circular inclusion/deposit |
| Winnowed | Loss of material that occurred during coring |
| Anthropogenic | Debris originated from human activity |

| MAJOR DIVISONS | | | GROUP SYMBOL | GRAPHIC SYMBOL | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| HIGHLY ORGANIC SOILS | | | PT | | Peat, Humus and Other Highly Organic Soils |
| COARSE-GRAINED SOILS More than 50% retained on No. 200 (0.075 mm) sieve | GRAVELS More than 50% of coarse fraction retained on No. 4 (4.75 mm) sieve | CLEAN GRAVELS Less than 5% fines | GW | | Well-graded Gravels, Gravel-Sand Mixtures, < 5% Fines * |
| | | | GP | | Poorly-graded Gravels, Gravel-Sand Mixtures, < 5% Fines * |
| | | GRAVELS WITH FINES Greater than 12% fines | GM | | Silty Gravels, Gravel-Sand-Silt Mixtures, > 12% Fines * |
| | | | GC | | Clayey Gravels, Gravel-Sand-Clay Mixtures, > 12% Fines * |
| | SANDS More than 50% of coarse fraction passing No. 4 (4.75 mm) sieve | CLEAN SANDS Less than 5% fines | SW | | Well-graded Sands, Gravelly Sands, < 5% Fines * |
| | | | SP | | Poorly-graded Sands, Gravelly Sands, < 5% Fines * |
| | | SANDS WITH FINES Greater than 12% fines | SM | | Silty Sands, Sand-Silt Mixtures, > 12% Fines * |
| | | | SC | | Clayey Sands, Sand-Clay Mixtures, > 12% Fines * |
| FINE-GRAINED SOILS 50% or more passes the No. 200 (0.075 mm) sieve | SILTS AND CLAYS Liquid Limit less than 50 | INORGANIC | ML | | Inorganic Silts and Very Fine Sands, Rock Flour, Silty Sands of Slight Plasticity |
| | | | CL | | Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays |
| | | ORGANIC | OL | | Organic Silts and Organic Silty Clays of Low Plasticity |
| | SILTS AND CLAYS Liquid Limit greater than 50 | INORGANIC | MH | | Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils |
| | | | CH | | Inorganic Clays of High Plasticity, Fat Clays |
| | | ORGANIC | OH | | Organic Clays of High Plasticity |

*NOTE: The use of dual group symbols are required if percent fines are between 5 and 12% (e.g. GW-GC).




# ATTACHMENT A-2

# Removal Evaluation Investigation and Sampling Training Checklists

**Attachment A-2.1**
**Removal Evaluation Investigation and Sampling Training Checklist**
**Intertidal Beach Sediment Sampling**

| Field Activity (Team Leads) | Task | Responsible Staff (to be completed during project kick-off) |
|---|---|---|
| ***Field Records (Nathan Soccorsy)*** | | |
| | Daily log | |
| | Daily safety meeting form | |
| | Sample collection forms | |
| | COCs | |
| | Incident report forms | |
| ***Surface Sediment Collection and Processing (Nathan Soccorsy)*** | | |
| | Location control (DGPS Operation) | |
| | 5-point surface sediment collection | |
| | Subsurface sediment collection | |
| | Sediment description | |
| | Homogenization procedures | |
| | Sample containers | |
| | Sample labels | |
| | Decontamination Procedures | |
| | Chain-of-custody procedures | |
| | Sample packing procedures | |
| | Sample storage | |
| | Sample transport | |

My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

| Date | Name (print) | Signature |
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| | | |

Project manager certification that project staff have received task-appropriate training

| Date | Name (print) | Signature |
|---|---|---|
| | Mark Larsen, Anchor QEA | |
| | | |

**Attachment A-2.2**
**Removal Evaluation Investigation and Sampling Training Checklist**
**Bluff Inspection and Contingent Sampling**

| Field Activity (Team Leads) | Task | Responsible Staff<br>(to be completed during project kick-off) |
|---|---|---|
| ***Field Records (Carla Brock)*** | | |
| | Daily log | |
| | Daily safety meeting form | |
| | Sample collection forms | |
| | COCs | |
| | Incident report forms | |
| ***Inspection and Contingent Soil/Seep Liquid Collection and Processing (Carla Brock)*** | | |
| | Location control (DGPS Operation) | |
| | PID/FID Operation | |
| | Soil sample collection | |
| | Seep sample collection | |
| | Homogenization procedures | |
| | Sample containers | |
| | Sample labels | |
| | Decontamination Procedures | |
| | Chain-of-custody procedures | |
| | Sample packing procedures | |
| | Sample storage | |
| | Sample transport | |

My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

| Date | Name (print) | Signature |
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Project manager certification that project staff have received task-appropriate training

| Date | Name (print) | Signature |
|---|---|---|
| | Jeremy Porter, Aspect | |
| | | |

**Attachment A-2.3**
**Removal Evaluation Investigation and Sampling Training Checklist**
**Inspection of Former Drainage and Piping System**

| **Field Activity (Team Leads)** | **Task** | **Responsible Staff (to be completed during project kick-off)** |
|---|---|---|
| ***Field Records (Carla Brock)*** | | |
| | Daily log | |
| | Daily safety meeting form | |
| | Incident report forms | |
| ***Inspection (Carla Brock)*** | | |
| | Location control (DGPS Operation) | |
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My signature below certifies that I have been trained on and understand the procedures outlined in this training checklist.

| **Date** | **Name (print)** | **Signature** |
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| | | |

Project manager certification that project staff have received task-appropriate training

| **Date** | **Name (print)** | **Signature** |
|---|---|---|
| | Jeremy Porter, Aspect | |
| | | |

# APPENDIX B
# QUALITY ASSURANCE PROJECT PLAN

# APPENDIX B
# QUALITY ASSURANCE PROJECT PLAN
# FINAL REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

### Prepared for: Cascade Natural Gas Corporation

Aspect Project No080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Prepared by

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

# APPENDIX B
# QUALITY ASSURANCE PROJECT PLAN
# FINAL REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC and Anchor QEA, LLC

## Approvals:

Aspect Project Manager
Jeremy Porter, Aspect

Date

Anchor QEA Project Manager
Mark Larsen, Anchor QEA

Date

EPA Remedial Project Manager
William Ryan, EPA

Date

EPA Project On Scene Coordinator
Kathy Parker, EPA

Date

EPA Region 10 QA Manager
Ginna Grepo-Grove, EPA

Date

# Contents

## List of Tables

# Acronyms

| | |
|---|---|
| AOC | Administrative Settlement Agreement and Order on Consent |
| ASTM | American Society for Testing and Materials |
| CCB | continuing calibration blanks |
| CCV | Continuing calibration verifications |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| COC | chemicals of concern |
| DQOs | data quality objectives |
| EDD | Electronic Data Deliverable |
| EPA | U.S. Environmental Protection Agency |
| FC | field coordinator |
| FID | Flame Ionization Detector |
| FSP | Field Sampling Plan |
| HASP | Health and Safety Plan |
| ICV | initial calibration verification |
| PM | project manager |
| LDC | Laboratory Data Consultants |
| MDL | method detection limit |
| µg/L | micrograms per liter |
| MNR | monitored natural recovery |
| MS/MSD | matrix spike/matrix spike duplicate |
| NAD | North American Datum |
| NAVD 88 | North America Vertical Datum 1988 |
| NELAP | National Environmental Laboratories Accreditation Program |
| NIST | National Institute of Standards and Technology |
| OSHA | Occupational Safety and Health Administration |

| | |
|---|---|
| PID | Photoionization Detector |
| PQL | practical quantitation limit |
| QA/QC | quality assurance/quality control |
| QAPP | Quality Assurance Project Plan |
| RL | reporting limit |
| RPD | relative percent difference |
| SDG | sample delivery group |
| SRM | Standard Reference Material |
| TOC | total organic carbon |

# 1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a remedial investigation and feasibility study (RI/FS) at the Bremerton Gasworks Site (Site), Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) entered into between Cascade and EPA on May 1, 2013.

This Quality Assurance Project Plan (QAPP) supports the Removal Evaluation Work Plan (Work Plan) which is required as the first task under the AOC. This QAPP presents detailed descriptions of the quality assurance/quality control (QA/QC) tasks to be performed during sampling and analysis activities supporting the removal evaluation activities.

The field sampling for the removal evaluation includes collection and chemical analysis of sediment samples from the intertidal beach area adjacent to the Site. As described in the Work Plan, a Time Critical Removal Action (TCRA) was performed in a portion of this area during 2010 in order to control the release of hydrocarbon sheen from a historical drain pipe. The sediment data collected during the current effort will be used to assess current conditions in the beach area, and to determine whether releases or threatened releases from the Site present an imminent and substantial endangerment to public health or welfare, or the environment which warrants performance of a removal action before completion of the RI/FS and selection of a final remedy. Detailed sampling and analysis methods are described in Appendix A of the Work Plan (Field Sampling and Analysis Plan [FSP]).

This QAPP was prepared in accordance with EPA *Requirements for Quality Assurance Project Plans* (EPA 2001) and EPA *Guidance on Quality Assurance Project Plans* (EPA 2002a). Analytical QA/QC procedures were also developed based on the analytical protocols and QA guidance of:

- EPA's Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition (EPA 1986).
- Guidance on Environmental Data Verification and Validation (EPA 2002b).
- Quality Assurance/Quality Control Guidance for Removal Activities (EPA 1990).
- Contract Laboratory Program National Functional Guidelines for Data Review (EPA 2004, 2008).

EPA's guidance specifies the four following groups of information that must be included in a QAPP: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability. Each group comprises several QAPP elements. EPA's guidance provides a suggested outline for the QAPP elements. However, the guidance indicates that certain elements may not be applicable to a given project, and that the elements need not be presented in the order presented in the guidance.

The remainder of this QAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Overview of Data Generation and Acquisition
- Section 4 – Assessments and Response Actions
- Section 5 – Data Validation and Usability
- Section 6 – References

# 2 Project Management

This section identifies key project personnel and their roles.

## 2.1 Project Organization

Responsibilities of the team members, as well as laboratory project manager, are described in this section. The following paragraphs define their functional responsibilities.

The regional project manager (RPM) is **William Ryan** of EPA. The primary role of the RPM is to ensure compliance with the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. EPA is the lead agency for this work.

The EPA on-scene coordinator (OSC) is **Kathy Parker**. The EPA OSC will be responsible for overseeing the removal evaluation. The EPA QA manager is **Ginna Grepo-Grove**. The QA manager is responsible for the QAPP review and approval and for providing QA oversight during sampling and analysis activities in support of the removal evaluation.

Cascade Natural Gas Corporation (Cascade) is the Respondent. **Kalle Kuether Godel** is the Cascade representative. The Anchor QEA and Aspect project managers (PMs) are **Mark Larsen** and **Jeremy Porter,** respectively. The project leads will act as the direct line of communication between Anchor QEA and Aspect, and the PMs are responsible for implementing activities described in this QAPP. **Dan Hennessy** and **Carla Brock** of Anchor QEA and Aspect, respectively, will be the task managers assisting the PMs. The project and task managers will be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The project and task managers will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this QAPP. Resolution of project concerns or conflicts related to technical matters will also be the responsibility of the project managers.

The Anchor QEA field coordinator (FC) will be **Nathan Soccorsy**. The FC will be responsible for day-to-day technical and QA/QC oversight. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratory for chemical and physical analyses.

The Anchor QEA Site Safety and Health Officer is **David Templeton.** The Site Safety and Health Officer will be responsible for managing on-Site health and safety activities and will provide support to the project manager and field coordinator on health and safety issues.

**Delaney Peterson** will serve as the Anchor QEA QA/QC manager. The QA/QC manager will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratory, ensuring data quality, overseeing data validation, and supervising project QA coordination.

**Laurel Menoche** will serve as the Anchor QEA data manager. The data manager will compile field observations and analytical data from the laboratory into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that the data obtained is in a format suitable for inclusion in the appropriate databases and delivery to EPA.

Samples collected by Anchor QEA and Aspect will be analyzed at Analytical Resources, Inc. (ARI), located in Tukwila, Washington. ARI is accredited under the National Environmental Laboratories Accreditation Program (NELAP). All chemical testing will adhere to SW-846 QA/QC procedures and analysis protocols (EPA 1986) or follow the appropriate ASTM International (ASTM) or Standard Method protocols. If more current analytical methods are available, the laboratory may use them.

**Cheronne Oreiro** will serve as the laboratory project manager at ARI. The laboratory project manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical analyses, and laboratory report preparation for this project. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analyses.

The analytical testing laboratory will be responsible for the following:

- Perform the methods described in this QAPP, including those methods referenced for each analytical procedure.
- Follow documentation, custody, and sample logbook procedures.
- Meet all reporting and QA/QC requirements.
- Deliver electronic data files as specified in this QAPP.
- Meet turnaround times for deliverables as described in this QAPP.
- Allow EPA and the QA/QC contractor to perform laboratory and data audits.

The Data Validator project manager will be Ming Hwang of Laboratory Data Consultants (LDC), and she will serve as the primary contact to perform all applicable data validation.

## 2.2 Distribution List

All group leaders and technical advisors will receive copies of this QAPP and any approved revisions.

This list identifies all individuals to receive one copy of the approved QAPP. Contact information is provided in Table 1 of the Work Plan:

- EPA Remedial Project Manager – William Ryan
- EPA On-Scene Coordinator – Kathy Parker
- Cascade Natural Gas Representative – Kalle Kuether Godel

- EPA Region QA Manager – Ginna Grepo-Grove
- Aspect Project Manager – Jeremy Porter
- Aspect Task Manager – Carla Brock
- Anchor QEA Project Manager – Mark Larsen
- Anchor QEA Task Manager – Dan Hennessy
- Anchor QEA QA/QC Manager – Delaney Peterson
- Anchor QEA Field Coordinator – Nathan Soccorsy

The following Laboratory Managers will receive one copy of the approved QAPP and FSP (Attachment A to the Work Plan):

- ARI – Cheronne Oreiro
- LDC – Ming Hwang (Data validation)

# 3 Project and Task Description

The objectives of the sampling and description of work and measurements to be performed are described in the following sections.

## 3.1 Objectives

As described in the Work Plan, a TCRA was performed by Cascade in 2010 to address hydrocarbon sheen in sediments in the vicinity of a historical drain pipe located at the beach adjacent to the former Gas Works. The TCRA was conducted under the oversight of the U.S. Coast Guard (USCG) and EPA, in coordination with the Washington Department of Ecology (Ecology), the Washington Department of Natural Resources (DNR), and the Kitsap County Health Department (KCHD).

Under EPA and USCG oversight, Cascade implemented a TCRA including completion of the following activities:

- Investigation of the location and orientation of the abandoned Pipe.
- Permanent plugging of the Pipe as close as practicable to the shoreline.
- Removal of all portions of the Pipe from the new plug to the terminus of the Pipe.
- Backfilling of the excavation created by removal of the Pipe with clean beach material.
- Placement of an Organo-Clay mat over impacted sediments near the terminus of the Pipe that had been observed to generate sheen with only minimal disturbance.
- Continued maintenance of a containment system and field observations and inspections to confirm the situation remains stable (no sheen).

The TCRA was successfully completed between November 5 and November 8, 2010. The results of the removal action were documented in a Completion Report (Anchor QEA 2011). Post-completion inspections of the removal action area have been performed on behalf of Cascade between 2010 and 2013. These inspections have been conducted pursuant to the TCRA Work Plan (Anchor QEA and Aspect 2010). Results of monitoring have shown that the removal action has contained the hydrocarbon sheen, and the temporary cap has been colonized by surface algae.

As required by the AOC, a removal evaluation will be performed prior to initiation of the RI/FS. The removal evaluation is intended to assess whether releases or threatened releases of contamination at the Site present an imminent and substantial endangerment to public health or welfare or the environment that warrants performance of an additional removal action before completion of the RI/FS and selection of a final remedy. Per the AOC, the primary objective of the removal evaluation is to assess whether contaminant migration pathways at the Site pose an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. If so, the removal evaluation will also:

- Identify one or more removal actions that may be conducted to effectively control any such migration pathways.

- Determine whether the boundaries of the identified removal action(s) can be defined as discrete from the larger investigation of the nature and extent of contamination at the Site.
- Propose boundaries for the identified removal action(s).
- Document available information regarding the presence of Site-associated contaminants and any non-aqueous phase liquids (NAPL) in soil, groundwater, or sediments within the proposed boundaries of the identified removal action(s).
- Describe the recommended methods for completing the identified removal action(s).
- Describe how implementation of the identified removal action(s) will be consistent with and facilitate final remediation of the Site.

The three data quality objectives (DQOs) of the removal evaluation are as follows:

- Collect the information necessary to evaluate whether current surface sediment contamination (0 to 4 inch depth interval) within the intertidal beach area adjacent to the former Gas Works poses an imminent and substantial threat to human health, welfare, or the environment if left unaddressed before completion of the RI/FS. Intertidal beach area sampling activities were specified in the AOC. The extent of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) in surface sediment within the beach area between the high tide line and the mean lower low water (MLLW) line will be characterized as specified in the AOC. These data will be used to estimate potential Site-related risks to beach users (evaluated using a child-exposure beach play scenario) and to benthic ecological receptors. If potential hydrocarbon sheen or odor is noted in subsurface sediments exposed during collection of the surface sediment samples, then a subsurface sample will be collected and archived from the 4 to 12 inch sampling interval at these locations. Detailed field collection methods are provided in the FSP. Anchor QEA will lead this field task.
- Inspect the former drainage and piping system connected to the 12-inch pipe addressed by the TCRA by surveying and locating potential influent sources to the drainage and piping system. These data will be used to identify potential ongoing or threatened migration pathways of contamination to the beach. Aspect will lead this field task.
- Inspect the area between the bluff and the high tide line for evidence of hydrocarbon seeps or other potential ongoing or threatened contaminant migration pathways to the beach. If potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, opportunistic soil samples will be collected and archived. The locations and properties of these archived opportunistic samples will be reviewed with EPA. Where directed by EPA, these opportunistic samples will be subjected to chemical analysis. If chemical analysis is performed for soil samples, these will be analyzed for PAHs and TOC using the same analysis methods used for analysis of the planned

surface sediment samples, as described in the FSP. Aspect will lead this field task.

## 3.2 Description of Work and Measurements to be Performed

The FSP describes in detail the data collection needs associated with the three removal evaluation DQOs including: sampling station locations, equipment to be used, location control, sample nomenclature, sampling intervals and analyses, and sampling protocols that will be followed.

# 4 Data Quality Objectives and Criteria

The primary analytical DQO for this project is to ensure that the data collected are of known and acceptable quality so that the project objectives described can be achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (also known as the "PARCC" parameters). Definitions of these parameters and the applicable QC procedures are included in this section. Applicable quantitative goals for these data quality parameters are listed or referenced in Table B-1.

## 4.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. ASTM recognizes two levels of precision: repeatability: 1) the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions and reproducibility; and 2) the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of blind field duplicates for chemistry samples at a frequency of 5 percent of samples analyzed. Field chemistry duplicate precision will be screened against a RPD of 50 percent for sediment samples. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\mathrm{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

| | | |
|---|---|---|
| RPD | = | relative percent difference |
| C1 | = | larger of the two observed values |
| C2 | = | smaller of the two observed values |

## 4.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, spiked project samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative laboratory control sample, and matrix spike recovery performance criteria outlined in Table B-1. Surrogate spike recoveries will be evaluated against laboratory control limits and internal standard recoveries will be evaluated against method criteria. Accuracy can be expressed as a percentage of the true or reference value, or as a percentage of the spiked concentration. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/Csa$$

Where:

| | | |
|---|---|---|
| %R | = | percent recovery |
| S | = | measured concentration in the spiked aliquot |
| U | = | measured concentration in the unspiked aliquot |
| Csa | = | actual concentration of spike added |

Field accuracy will be controlled by adherence to sample collection procedures outlined in the FSP (Appendix A of the Work Plan).

## 4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the sampling program, the list of analytes has been identified to provide a comprehensive assessment of the known and potential contaminants at the Site.

## 4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

## 4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{\text{(Number of acceptable data points) x 100}}{\text{(Total number of data points)}}$$

The DQO for completeness for all components of this project is 95 percent. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

## 4.6 Sensitivity

Sensitivity is measured by the achievable laboratory detection and reporting limits. The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory reporting limits (RLs) are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Detected results will be reported to the MDL level and non-detected results will be reported to the RL due to the 50 percent false negative rate assumed at the MDL level. Results between the MDL and the RL will be qualified “J” to indicate they are estimated.

The sample-specific MDL and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the reporting limit (e.g., dilution factor, percent moisture, sample mass). In the event that the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., reporting limits less than criteria are achieved), EPA will be contacted to discuss an acceptable resolution.

# 5 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized sample collection requirements so that the samples collected and subsequent data generated are consistent with project requirements. All field crew are fully trained in the operation of equipment, collection and processing of surface sediments, decontamination protocols, visual inspections, and sample transport and chain-of-custody procedures. All field staff are required to read the Work Plan, FSP, and QAPP prior to beginning field work. All field staff are also required to participate in a field project kick-off meeting to review field tasks and to verify that staff understand and are trained for the site-specific field tasks. Training requirements for field tasks for the removal evaluation will be documented on the Field Training Documentation Forms (FSP Attachment A-2). Upon completion of project training and competency certification, the Anchor QEA and Aspect project managers will sign-off on this form to document the qualifications and training of the field crew.

The Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health (29 CFR 1910.120). All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

# 6 Documentation and Records

This project will require central project files to be maintained at the Anchor QEA office conducting the work. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but must provide such files to the central project files upon completion of each task. A project-specific index of file contents is to be kept with the project files. Hard copy documents will be kept on file at Anchor QEA or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in the database at Anchor QEA.

Deviations from the QAPP or FSP will be discussed with the project leads prior to implementation. Project leads will contact the on-Site EPA representative to discuss the deviation and proposed path forward. Upon approval of a path forward, the project leads will give notice to proceed to the FC. All deviations will be documented in all associated field forms and the logbook.

## 6.1 Field Records

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field forms. Example field forms are provided in the FSP (Appendix A of the Work Plan). All field activities will be recorded on forms specific to the collection activity and will be maintained by the FCs. Field forms will be the main source of field documentation for all field activities. The on-Site field representative will record on the field log form information pertinent to the investigation program. The sampling documentation will contain information about each sample collected, and will include at a minimum the following information:

- Project name.
- Field personnel on Site.
- Weather conditions.
- Field observations.
- Maps and/or drawings.
- Date and time sample collected.
- Sampling method and description of activities.
- Identification or serial numbers of instruments or equipment used.
- Deviations from the QAPP.
- Conferences associated with field sampling activities.

Entries for each day will begin on a new form. The person recording information must enter the date and time and initial each entry. Additional specific field reporting requirements and checklists for each study are defined in the FSP. In general, sufficient information will be recorded during sample collection so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms and field logbook will be on water-resistant, durable paper for adverse field conditions. Notes will be taken in indelible waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. Each form will be marked with the project name, number, and date. The field forms will be scanned into Anchor QEA's project file directory upon completion of the sampling event.

## 6.2 Analytical and Chemistry Records and Deliverables

Analytical data records will be retained by the laboratories and Anchor QEA. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data. Laboratory analytical reports will be provided to Anchor QEA in PDF format and the Electronic Data Deliverable (EDD) will be provided in the Anchor QEA EQuIS 5 format. The analytical laboratory will be required to report the following:

- Project Narrative. This summary, in the form of a cover letter, will discuss any problems encountered during any aspect of analyses. This summary should discuss but should not be limited to QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered—actual or perceived—and their resolutions will be documented in as much detail as appropriate.
- Chain-of-custody Records. Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- Sample Results. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
    - Field sample identification code and the corresponding laboratory identification code.
    - Sample matrix.
    - Date of sample preparation.
    - Date and time of analysis.
    - Weight and/or volume used for preparation/analysis.
    - Final dilution volumes or concentration factor for the analysis.
    - Identification of the instrument used for analysis.

- Method detection limits and method reporting limits accounting for sample-specific factors (e.g., dilution, total solids).
- Analytical results with reporting units identified.
- Data qualifiers and their definitions.

- QA/QC Summaries. Results of the laboratory QA/QC procedures will be summarized for each analytical event. Each QA/QC sample analysis will be documented with the same information required for the sample results (see previous bullet point). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
  - Internal standard area summaries.
  - Method blank results.
  - Surrogate spike recoveries.
  - Matrix spike/matrix spike duplicate recoveries and RPD values.
  - Matrix duplicate RPD values.
  - Laboratory control sample/laboratory control sample duplicate recoveries.
- Calibration Data Summary. This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
- Original Data. Legible copies of the original data generated by the laboratory will include:
  - Sample preparation, identification of preparation method used, and cleanup logs.
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis.
  - Calculation worksheets for inorganic analyses.
  - Reconstructed ion chromatograms for all sample, standard, blank, calibration, spike, replicate, and reference material results.
  - Original printouts of full scan chromatograms and quantitation reports for all gas chromatography (GC) and/or GC/mass spectrometry (MS) sample, standard, blank, calibration, spike, replicate, and reference material results.
  - Enhanced and unenhanced spectra of detected compounds with associated best-match spectra for each sample.

All instrument data shall be fully restorable at the laboratory from electronic backup. Laboratories will be required to maintain all records relevant to project analyses for a minimum of seven years. Data validation reports will be maintained in the central project files with the analytical data reports.

## 6.3 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the department lead, the laboratory project manager, and/or the QA/QC managers. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

## 6.4 Removal Evaluation Reporting

A Removal Evaluation Report will be submitted following completion of the sampling and analysis activities. This report will be prepared by Anchor QEA and Aspect. Data collected during the removal evaluation will also be included in the RI/FS Scoping document and RI/FS Work Plan. The Removal Evaluation Report shall include the following, as applicable:

- Description of the sampling and analysis activities conducted.
- Schedule under which such activities were conducted.
- Description and supporting analytical data for known hazardous substances remaining on-Site after completion of the TCRA.
- Locations, lab reports, and summary of results of sample collection and analyses.
- Data validation reports of analytical data.
- Description of the management of investigation-derived wastes.

# 7 Overview of Data Generation and Acquisition

All sample collection will be conducted following standard procedures. In general, all sampling procedures will comply with EPA protocols or other approved sample collection standards established for the Site.

## 7.1 Sampling Rationale

The investigation and sampling rationale for the three DQOs of the removal evaluation are described in the Work Plan. Analytical sampling will be conducted as part of the intertidal beach sampling activities, and potentially may be conducted during the bluff inspection. The extent of sampling to be performed is specific to the removal evaluation, and is intended to fill specific data gaps defined by EPA. Analytical sampling will not be conducted for the inspection of the former drainage and piping system.

The extent of surface sediment sampling within the intertidal beach area is consistent with the requirements of the AOC. That sampling is intended to provide information on current surface sediment quality in the intertidal beach area adjacent to the former Gas Works. This information will be used to support a screening level risk evaluation for recreational beach users as requested by EPA. Thirty sample stations will be located in the vicinity of the 2010 TCRA and the beach area adjacent to the former Gas Works. Opportunistic subsurface sediment samples will be collected in the event that subsurface hydrocarbon sheen or visible product is noted during the collection of the surface sediment samples.

The bluff inspection and contingent sampling will be used to assess the potential presence of heavily impacted soils or hydrocarbon seeps along the bluff between the former Gas Works and the intertidal beach area. As described in the Work Plan, analytical sampling will be conducted if hydrocarbon stains or odors, or visual hydrocarbon seeps are noted during the bluff inspection.

## 7.2 Sampling Methods

The sampling methods for the two DQOs with specified or contingent analytical sampling are described the FSP. As described in the FSP, the surface sediment sampling in the intertidal beach area will be conducted using local station composites. Each surface sediment sample submitted for testing will consist of five equal aliquots of sediment, one collected from the target location and four collected each approximately 3 feet from the target location at the approximate four points of the compass. If surface sediments with potential hydrocarbon sheen or odor are identified, additional local station composite samples of surface sediment may be collected and archived from these locations.

In the event that opportunistic subsurface sediment samples are collected from the proposed beach surface sediment locations, these will be collected as discrete samples. However, if hydrocarbon sheen or product is noted in multiple points within a local station composite, then the discrete subsurface samples from that location station exhibiting hydrocarbon sheen or product will be composited.

During the bluff inspection, if potential hydrocarbon seeps are indicated by visual observation of hydrocarbon staining, sheen, or odor, soil or seep liquid samples will be collected and archived. A photoionization detector (PID) or flame ionization detector (FID) will also be used to help detect the presence of hydrocarbon vapors. Any samples collected during the bluff inspection will consist of discrete samples as described in the FSP.

All prescribed or opportunistic sediment samples will be collected with decontaminated stainless steel trowels into decontaminated stainless steel bowls, homogenized, and placed into sample containers as listed in Table A-2 of the FSP. Potential opportunistic bluff soil/seep samples will be collected using the same sampling techniques.

## 7.3 Sample Handling and Custody

The sample handling and custody procedures are described in the FSP. All containerized sediment samples will be delivered to the designated analytical laboratories daily by hand or by courier after preparation is completed. Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample containers will sign the chain-of-custody forms. Upon receipt, the laboratory receiver will record the temperature and condition of the samples and cross-check the sample inventory with the chain-of-custody forms. Chain-of-custody forms will be used internally in the lab to track sample handling and final disposition.

## 7.4 Analytical Methods

This section summarizes the target chemical and physical analyses for the various media sampled. All sample analyses will be conducted in accordance with EPA-approved methods and this QAPP. Chemical testing will be conducted at the selected analytical laboratory. The selected analytical laboratory is accredited under NELAP. Prior to analysis, all samples will be maintained according to the appropriate holding times and storage temperatures for each analysis. Table B-2 presents the proposed analytes, the analytical methods to be used, and the targeted reporting limits. All surface sediment samples will be analyzed for TOC and SIM PAHs. An archive sample from each station will be kept in frozen storage for possible future analyses, should any be determined necessary.

The laboratory will establish method detection limits for each analyte of interest, where applicable prior to sample analyses. Method reporting limits will be below the values specified in Table B-2, if technically feasible. The method reporting limits listed in Table B-2 are the laboratory’s established and lowest achievable reporting limits for PAH analysis. The PAH reporting limits are sufficient to support the preliminary evaluation of exposure risk to recreational beach users (see Appendix D). These reporting limits may not be achieved in the event that constituent concentrations are elevated or if there are matrix interferences. If specified reporting limits are not achieved, possible corrective actions will be discussed with the laboratory and with EPA. If analytical methodology modifications are to be used to address raised reporting limits, these will be presented to EPA for review and approval prior to implementation.

In completing chemical analyses for this project, the contract laboratory is expected to meet the following minimum requirements:

- Adhere to the analytical methods outlined in this QAPP.
- Deliver scanned and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in the QAPP including data quality objectives, laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA/QC manager of any QAPP QA/QC deviations when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

## 7.5 Quality Assurance/Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846 (1986), the EPA Contract Laboratory Program (EPA 2004, 2008), and other cited methods.

### *7.5.1 Field Quality Control*

Anchor QEA personnel will identify and label sample containers in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to conduct required analyses properly. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

#### *7.5.1.1* Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided.

#### *7.5.1.2* Sample Identification and Labels

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identification
- Date and time of sample collection

- Preservative type (if applicable)
- Analysis to be performed

Samples will be uniquely identified with a sample identification that at a minimum specifies sample number, sample location, and type of sample. Specific sample ID schemes are provided in the FSP.

#### *7.5.1.3* Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for collecting and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples includes equipment rinsate blanks and field duplicates. Rinsate blanks will be collected at a rate of one per collection event for SIM PAH analysis. Field duplicate samples will be collected at a frequency of one per 20 samples collected. Any field QA sample result that significantly exceeds the acceptance criteria will be evaluated by the QA/QC manager to determine if field procedure modifications should be considered. These exceedances will also be narrated in the Data Report. Sample data will not be qualified based solely on field QA results.

Field QA samples will also include the collection of enough sample mass to ensure that the laboratory has sufficient amounts to run the program-required analytical QA/QC (matrix spike/matrix spike duplicate [MS/MSD]) samples for analyses as specified in Table B-3. For sediment and soil samples, enough mass will be collected to run MS/MSD on any sample. The samples designated for QA/QC analyses will be clearly marked on the chain-of-custody.

All field QA samples will be documented on the field forms and verified by the QA/QC manager or designee.

### *7.5.2 Laboratory Quality Control*

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, matrix spikes, surrogate spikes (for organic analyses), and method blanks. Table B-1 summarizes the data quality objectives for precision, accuracy, and completeness and Table B-3 lists the frequency of analysis for laboratory QA/QC samples.

Results of the QC samples from each analytical batch will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

#### 7.5.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. An initial calibration verification (ICV) will be analyzed following each initial calibration and must meet method criteria prior to analysis of samples. Continuing calibration verifications (CCV) will be performed daily prior to any sample analysis to track instrument performance. The frequency of CCV analyses varies with methods. For GC/MS methods, one will be analyzed every 12 hours. For inorganic methods, one will be analyzed for every 10 field samples analyzed or at the beginning and end of the analytical run, whichever is more frequent. If the continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks (CCB) provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or following continuing calibration verification of the instrument for each type of applicable analysis.

#### 7.5.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

#### 7.5.2.3 Matrix Spike and Matrix Spike Duplicates

Analysis of MS samples provides information on the preparation efficiency of the method on the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided. The frequency of analysis for matrix spike and matrix spike duplicate samples is provided in Table B-3.

#### 7.5.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the method reporting limit of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound, and the concentration of the analyte/compound in any of the associated samples is less than five times the concentration found in the blank (10 times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced. Any affected samples will be re-prepared and reanalyzed as necessary. The frequency of analysis for method blank samples is provided in Table B-3.

#### 7.5.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared along with the samples and any other required laboratory QC samples. The laboratory control sample will provide information on the accuracy of the analytical process, and when analyzed in duplicate, will provide precision information as well. The frequency of analysis for laboratory control samples is provided in Table B-3.

##### 7.5.2.6 Standard Reference Materials

Standard reference materials are substances of the same or similar matrix to the project samples and contain a known concentration of target analyte(s). These materials are prepared and analyzed in the same manner as routine samples and in the same preparation and analytical batch. The recovery of the target analyte(s) provide information on interferences caused by the sample matrix. National Institute of Standards and Materials (NIST) standard reference material (SRM) 1941b for organics in marine sediment will be analyzed for SIM PAHs and TOC. The frequency of analysis for standard reference material samples is provided in Table B-3.

##### 7.5.2.7 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. QC sample frequencies will be compared to the criteria in Table B-3.

## 7.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

### *7.6.1 Field Instruments/Equipment*

Anchor QEA maintains inventories of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer’s recommendations and/or previous experience with the equipment.

The FCs will be responsible for the preparation, documentation, and implementation of the preventative maintenance. The equipment maintenance information will be documented in the instrument’s calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer’s instruction manuals.

All maintenance records will be verified prior to each sampling event. The FCs will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field.

### 7.6.2 Laboratory Instruments/Equipment

The laboratories selected will maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratories selected will have a preventative maintenance program, as detailed in their QA Plans, organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The QA/QC managers will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The QA/QC managers will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times. Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. A laboratory QA/QC manager or designee shall be responsible for verifying compliance.

## 7.7 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

### 7.7.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, the chemistry laboratories selected will perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibrations procedures and frequencies are discussed in the laboratory standard operating procedures (SOPs) and the analytical methods.

The laboratory QA/QC manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and

Technology (NIST). Chemical reference standards shall be NIST Standard Reference Materials (SRMs) or vendor certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

## 7.8 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FCs. All primary chemical standards and standard solutions used in this project either in the field or laboratory will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

## 7.9 Laboratory Data Management

ARI will provide data to the Anchor QEA data manager in the EQuIS electronic data deliverable format as well as in PDF form. Electronically provided laboratory data will be loaded into the database and verified against the laboratory data report. The laboratory data will undergo Stage 3 (EPA 2009) manual validation. Stage 4 validation may be performed on a portion of the data if considered necessary. Qualifiers, if assigned, will be entered manually. The accuracy of manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.

## 7.10 Field Data Management

Field data sheets will be checked for completeness and accuracy by the FCs prior to delivery to the data managers. All data generated in the field will be documented on hard copy and provided to the office data managers, who are responsible for the data's entry into the database. All manually entered data will be verified by a second party. Field documentation will be filed in the Anchor QEA central project file of the office generating the data after data entry and checking are complete.

# 8 Assessments and Response Actions

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

## 8.1 Compliance Assessments

Laboratory and field performance audits consist of on-Site reviews of QA systems and equipment for sampling, calibration, and measurement.

Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA/QC managers upon request. The laboratory is required to have written procedures addressing internal QA/QC; these procedures have been submitted and will be reviewed by the project QA/QC managers to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review of written details of any and all method modifications planned. Laboratory non-conformances will be documented and submitted to the QA/QC managers for review. All non-conformances will be discussed in the final data report.

The database manager will work with the FC and the project leads to correct any questionable or incomplete data. All corrections to field forms will be signed and dated by the personnel making the change.

Field data will be verified by the database manager. These tasks include:

- Post-processed differential correction of GPS coordinates.
- Sample parameter review (e.g., depth, sample name, sample matrix, unit).
- Field QC assignment (e.g., duplicates assigned to parent, equipment blanks assigned to samples).

## 8.2 Response and Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or nonconformance to protocols identified in this document.

### *8.2.1 Field Activities*

The FCs will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC managers will be responsible for resolving situations identified by the FCs that may result in noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

### 8.2.2 Laboratory

The laboratory is required to comply with their SOPs. The laboratory managers will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The laboratory managers will be notified immediately if any QC sample result exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analyses. The laboratory managers will document the corrective action taken in writing. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalyses, and/or re-extraction) will be submitted with the data package in the form of a cover letter.

## 8.3 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC managers.

Progress reports will be prepared by the FCs following each sampling event. The QA/QC managers will also prepare progress reports after the sampling is completed and samples have been submitted for analyses, when information is received from the laboratory, and when analyses are complete. The status of the samples and analyses will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the Anchor QEA project lead.

# 9 Data Validation and Usability

This section describes the processes that will be used to review project data quality.

## 9.1 Data Review, Validation, and Verification

The removal evaluation data will undergo EPA Stage 2B validation. Some of the data may undergo EPA Stage 4 validation, if considered necessary. During the validation process, analytical data will be evaluated for QAPP, method, and laboratory quality control compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

## 9.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FCs and laboratory managers; review by the data managers for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into Anchor QEA's EQuIS database. Verification of the electronic data with the laboratory reports will be performed by a data manager or designee. All manually entered data and all manually assigned qualifiers will be verified. Any errors found will be corrected.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the laboratory managers to determine whether corrective action is needed and to determine the impact on the reporting schedule.

The Anchor QEA QA/QC manager or designee will be responsible for checking data packages for completeness immediately upon receipt from the laboratory. This will ensure that data and QA/QC information requested are present. Data quality will be assessed by a reviewer using the current National Functional Guidelines for data review (EPA 1999, 2004, 2008) and Guidance on Environmental Data Verification and Validation (EPA 2002b) by considering the following:

- Holding times
- Initial calibrations

- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Standard reference materials
- Overall conformance with project DQOs

The data will be validated in accordance with the project specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs. Data validation will be performed by the Anchor QEA QA/QC manager, designee, or by a third party data validator. The data validation will be summarized in a validation report to be included with the Removal Evaluation Report. Any data qualifiers added as part of validation will be input into the Equis database.

## 9.3 Reconciliation with User Requirements

The QA/QC manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/QC manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors, and will suggest corrective action. It is expected that the problem would be corrected by revision of techniques or replacement of supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC manager will recommend appropriate modifications. Any revisions will require approval by EPA. If matrix interference is suspected to have caused the exceedance, adequate lab documentation must be presented to demonstrate that instrument performance and/or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per National Functional Guidelines (EPA 1999, 2004, 2008). In these instances, the usability of the data will be determined by the extent of the exceedance.

# 10 References

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# TABLES

**Table B-1**
**Project Data Quality Objectives**

| Parameter | Precision | Accuracy[1] | Method Blank | Completeness |
|---|---|---|---|---|
| Total solids | ± 20% RPD | NA | NA | 95% |
| Total organic carbon | ± 20% RPD | 75-125% R | ≤ PQL[a] | 95% |
| Polycyclic aromatic hydrocarbons | ± 35% RPD | 50-150% R | ≤ PQL[a] | 95% |

Notes:
1 = Applies to MS/MSD and LCS/LCSD recoveries
a = When the sample concentration is < 5x the method blank concentration
LCS/LCSD = laboratory control sample/laboratory control sample duplicate
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
PQL = practical quantitation limit
R = recovery
RPD = relative percent difference

**Table B-2**
**Parameters for Analysis, Methods, and Quantitation Limits**

| Parameter | Recommended Analytical Method | Quantitation Limits |
|---|---|---|
| **Conventional parameters (%)** | | |
| Total solids | SM 2540B | 0.1 |
| Total organic carbon | PSEP | 0.1 |
| **Polycyclic aromatic hydrocarbons (µg/kg dry weight)** | | |
| 1-Methylnaphthalene | 8270D-SIM | 0.5 |
| 2-Methylnaphthalene | 8270D-SIM | 0.5 |
| Acenaphthene | 8270D-SIM | 0.5 |
| Acenaphthylene | 8270D-SIM | 0.5 |
| Anthracene | 8270D-SIM | 0.5 |
| Benz(a)anthracene | 8270D-SIM | 0.5 |
| Benzo(a)pyrene | 8270D-SIM | 0.5 |
| Benzo(b)fluoranthene | 8270D-SIM | 0.5 |
| Benzo(g,h,i)perylene | 8270D-SIM | 0.5 |
| Benzo(j)fluoranthene | 8270D-SIM | 0.5 |
| Benzo(k)fluoranthene | 8270D-SIM | 0.5 |
| Chrysene | 8270D-SIM | 0.5 |
| Dibenzo[a,h]anthracene | 8270D-SIM | 0.5 |
| Dibenzofuran | 8270D-SIM | 0.5 |
| Fluoranthene | 8270D-SIM | 0.5 |
| Fluorene | 8270D-SIM | 0.5 |
| Indeno(1,2,3-c,d)pyrene | 8270D-SIM | 0.5 |
| Naphthalene | 8270D-SIM | 0.6 |
| Phenanthrene | 8270D-SIM | 0.5 |
| Pyrene | 8270D-SIM | 0.5 |

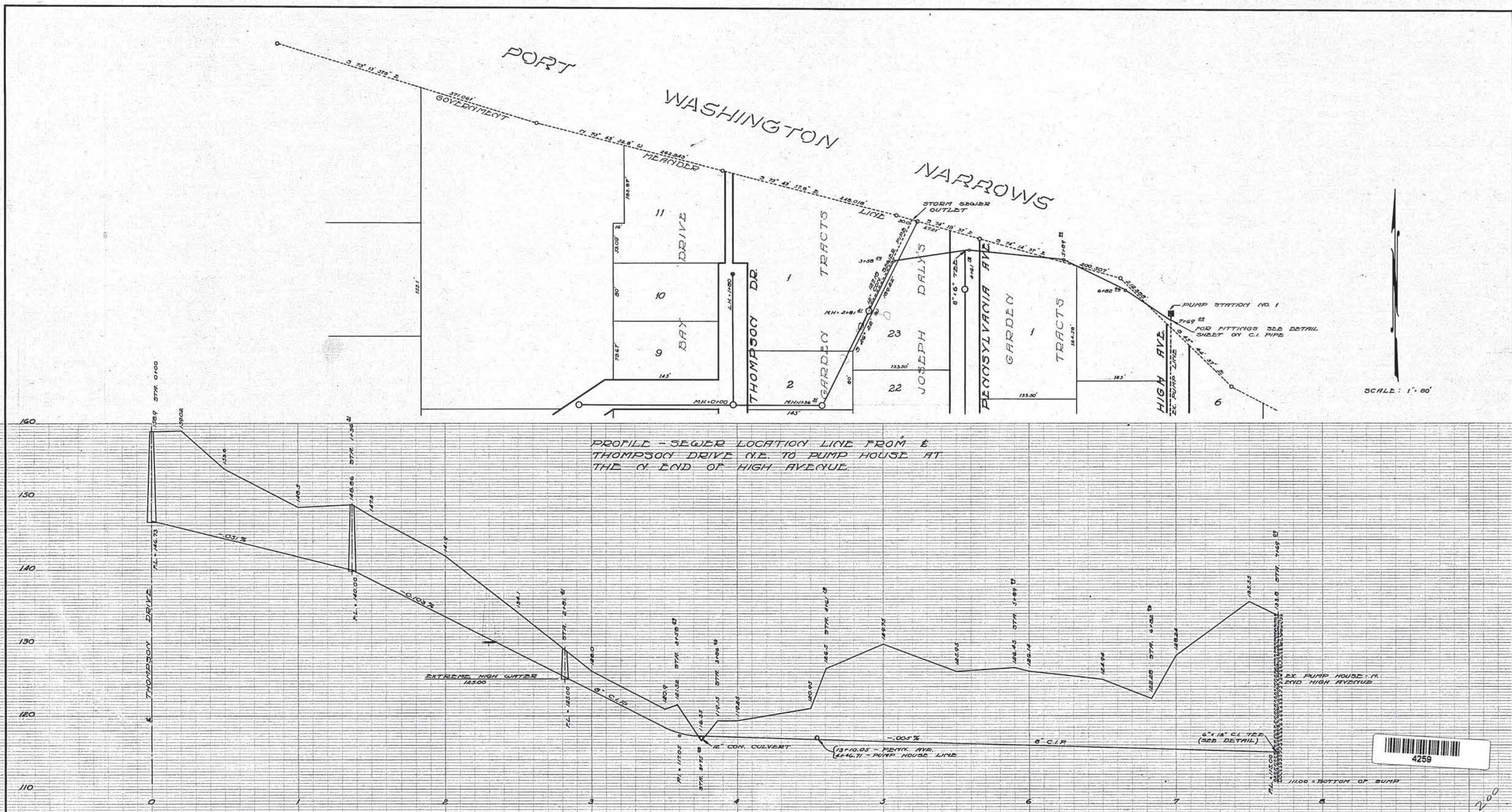
Notes:
µg/kg = micrograms per kilogram
PSEP = Puget Sound Estuary Program
SIM = selective ion monitoring

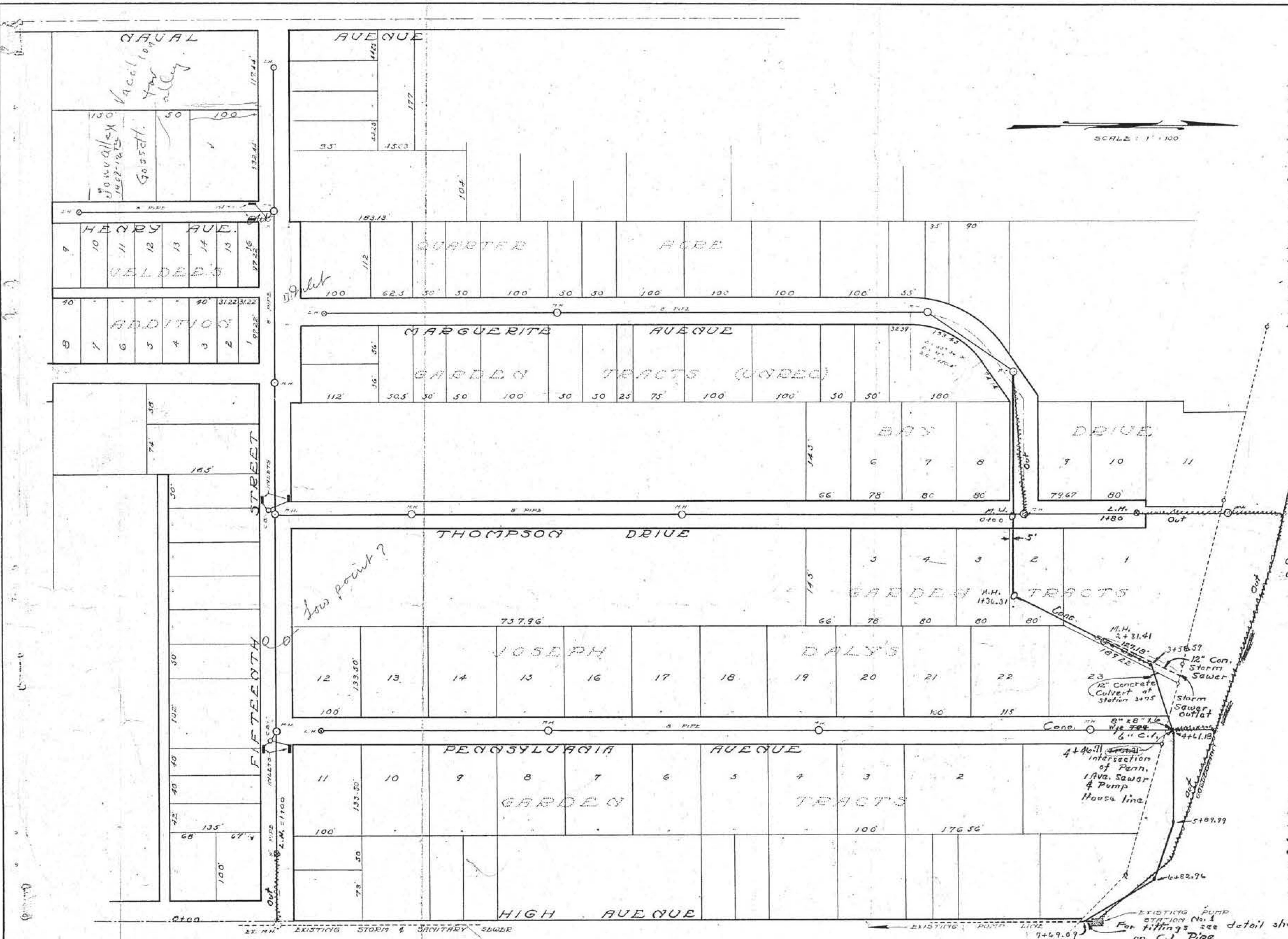
**Table B-3**
**Laboratory Quality Control Sample Analysis Frequency**

| Analysis Type | Initial Calibration | Ongoing Calibration | Standard Reference Material[d] | Replicates | Matrix Spikes | Matrix Spike Duplicates | Method Blanks | Surrogate Spikes | Laboratory Control Samples |
|---|---|---|---|---|---|---|---|---|---|
| Total solids | Daily[a] | NA | NA | 1 per 20 samples | NA | NA | NA | NA | NA |
| Total organic carbon | Daily or each batch[b] | 1 per 10 samples | 1 per 20 samples | 1 per 20 samples | 1 per 20 samples | NA | Each batch | NA | 1 per 20 samples |
| Polycyclic aromatic hydrocarbons | As needed [c] | Every 12 hours | 1 per 20 samples | NA | 1 per 20 samples | 1 per 20 samples | Each batch | Every sample | 1 per 20 samples |

Notes:
a = Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
b = Initial calibration verification and calibration blank must be analyzed at the beginning of each batch.
c = Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new calibration is performed.
d = When a Standard Reference Material is available
NA = not applicable

# APPENDIX C
# RECORD DRAWINGS


PORT WASHINGTON NARROWS
GOVERNMENT MEANDER LINE
STORM SEWER OUTLET
BAY DRIVE
THOMPSON DR.
GARDEN TRACTS
JOSEPH DALY'S GARDEN TRACTS
PENNSYLVANIA AVE.
HIGH AVE.
EX. PUMP LINE
PUMP STATION NO. 1
FOR FITTINGS SEE DETAIL SHEET ON C.I. PIPE
SCALE: 1" = 80'
PROFILE - SEWER LOCATION LINE FROM ℄ THOMPSON DRIVE N.E. TO PUMP HOUSE AT THE N. END OF HIGH AVENUE.
℄ THOMPSON DRIVE
EXTREME HIGH WATER 125.00
12" CON. CULVERT
13+10.05 - PENN. AVE.
6+46.71 - PUMP HOUSE LINE
8" C.I.P.
6" x 12" C.I. TEE (SEE DETAIL)
EX. PUMP HOUSE - N. END HIGH AVENUE
111.00 = BOTTOM OF SUMP




# PLAN

FOR THE IMPROVEMENT OF HENRY AVENUE FROM A POINT 265' SOUTH OF FIFTEENTH STREET NORTH TO THE CENTER LINE OF FIFTEENTH STREET; MARGUERITE AVENUE NORTH FROM FIFTEENTH STREET TO ITS INTERSECTION WITH THOMPSON DRIVE, THOMPSON DRIVE NORTH FROM FIFTEENTH STREET TO A COLLECTION LINE ALONG PORT WASHINGTON NARROWS; PENNSYLVANIA AVENUE NORTH FROM FIFTEENTH STREET TO A COLLECTION LINE ALONG PORT WASHINGTON NARROWS; FIFTEENTH STREET FROM NAVAL AVENUE EAST TO HIGH AVENUE, COLLECTION LINE FROM THE NORTH END OF THOMPSON DRIVE SOUTHEASTERLY ALONG PORT WASHINGTON NARROWS TO THE PUMP AT THE NORTH END OF HIGH AVENUE, BY A SYSTEM OF STORM AND SANITARY SEWERS.

# CERTIFICATION

AUTHORIZED BY ORDINANCE NO. CREATING LOCAL IMPROVEMENT DISTRICT NO. APPROVED THIS DAY OF 1939.

MAYOR

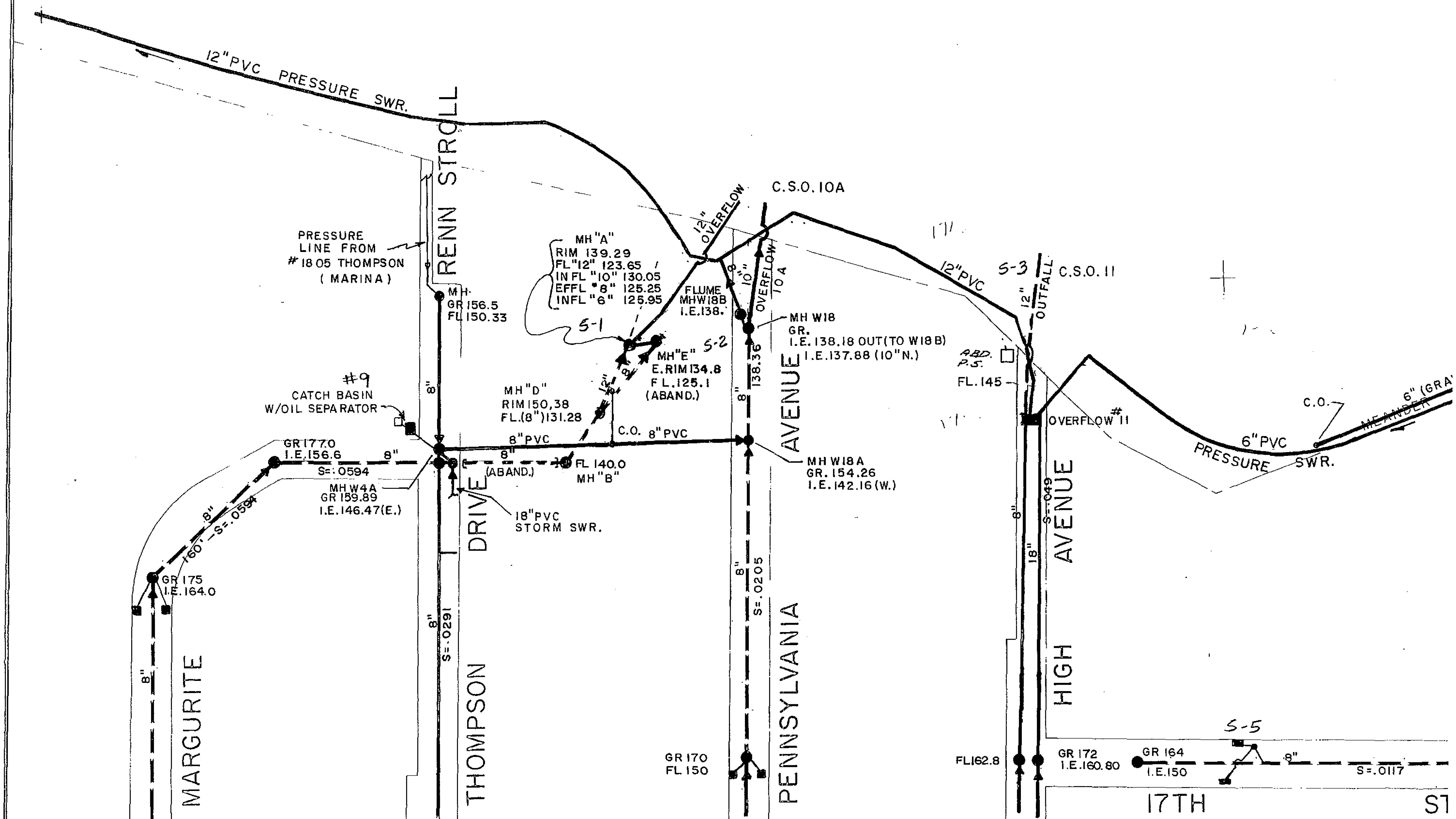
ATTEST: CITY CLERK

APPROVED: CITY ENGINEER

# QUANTITIES

| | | |
|---|---|---|
| 1. | FIXED ESTIMATE | ACTUAL COST |
| 2. | CLEARING & GRUBBING | LUMP SUM |
| 3. | 8" PIPE - INCLUDING 6"x8" WYES | 3640 FEET |
| 4. | 6" PIPE | 480 FEET |
| 5. | MANHOLES | 14 |
| 6. | LAMPHOLES | 4 |
| 7. | CATCH BASINS | 3 |
| 8. | INLETS | 6 |
| 9. | 8" C.I.P. | 650 FEET |

4263

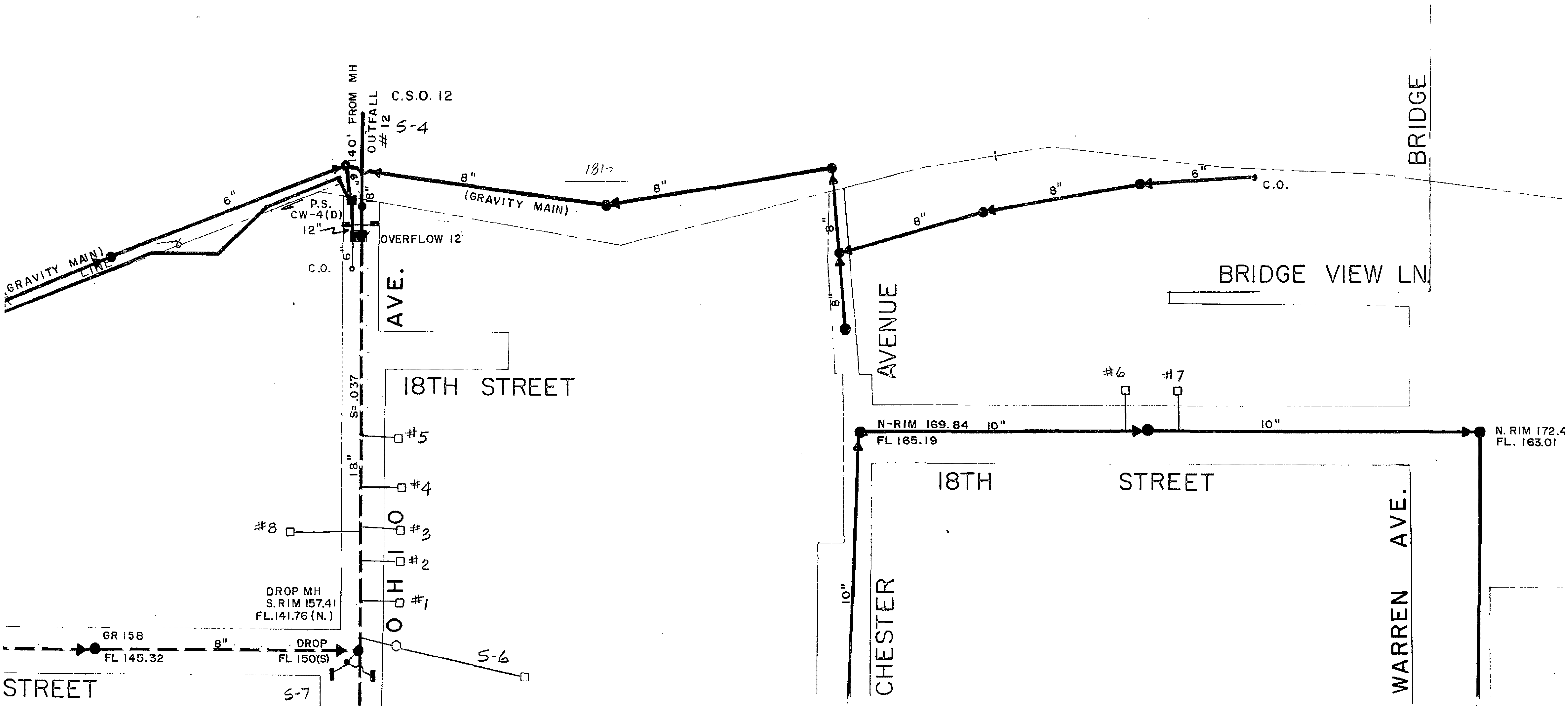



| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| 4-6-92 | AEL | ADD SAN./STORM CONN. | CB | C.B. FIELD NOTES |
| 1-6-89 | AEL | RE-DRAW 8",10" & 12" PRESSURE SWRS. | | CONTR. C6 ($CH_2M$ HILL DWG.) CONTR. C10 |
| 1-6-89 | AEL | COMB. STORM/SAN. SWRS. | | ENG. DEPT SWR. CARDS |
| DATE | BY | REVISION | APPD. | REFERENCES |

ENGINEERING DEPARTMENT

CITY of BREMERTON

THIS MAP IS NOT INTENDED TO REP... THE PRECISE LOCATION OR THE EXTENT OF BREMERTON MUNICIPAL UTILITIES PRESENT OR FUTURE FACILITIES




COMBINED STORM & SANITARY SEWER

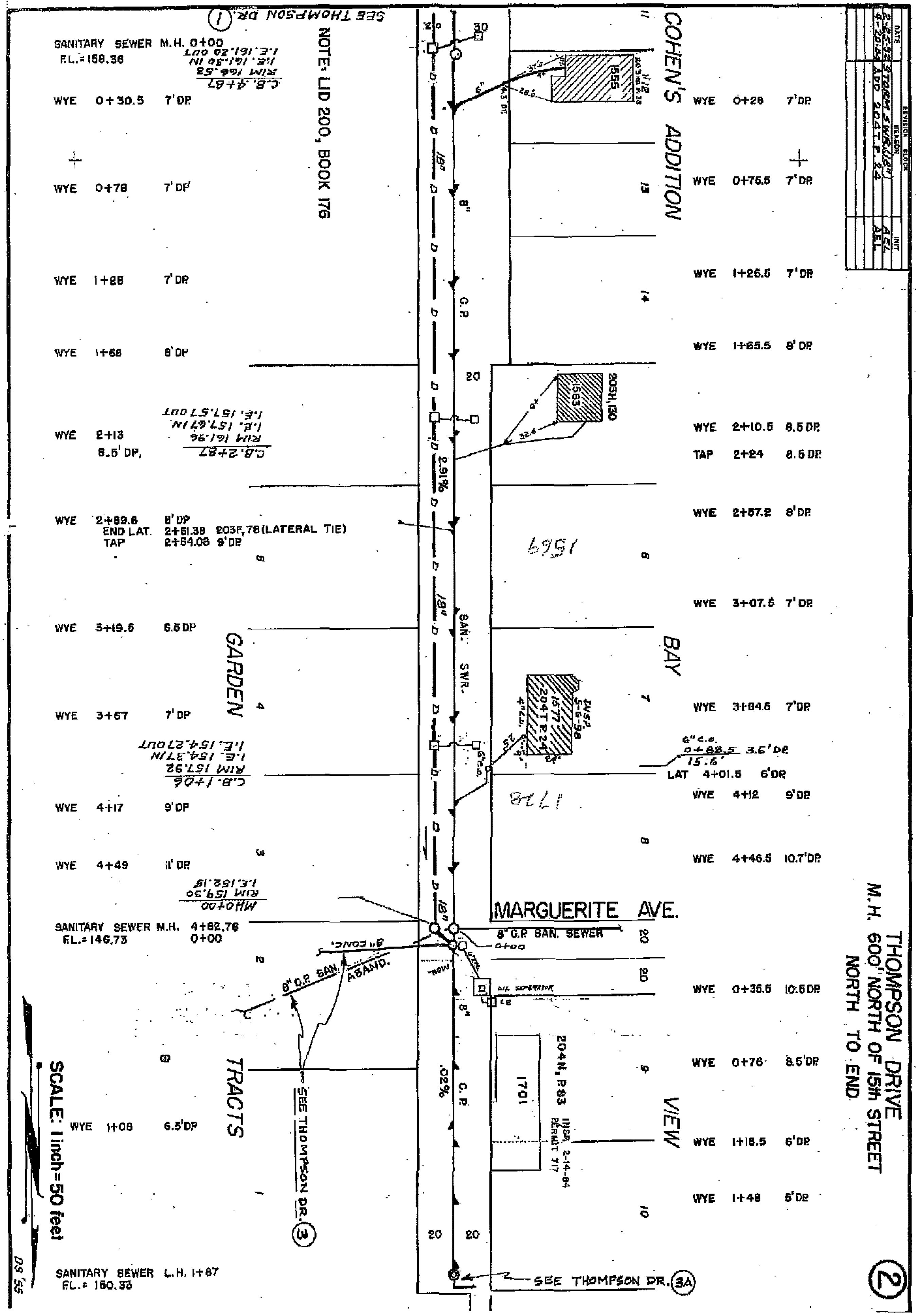
# SANITARY SEWER SYSTEM

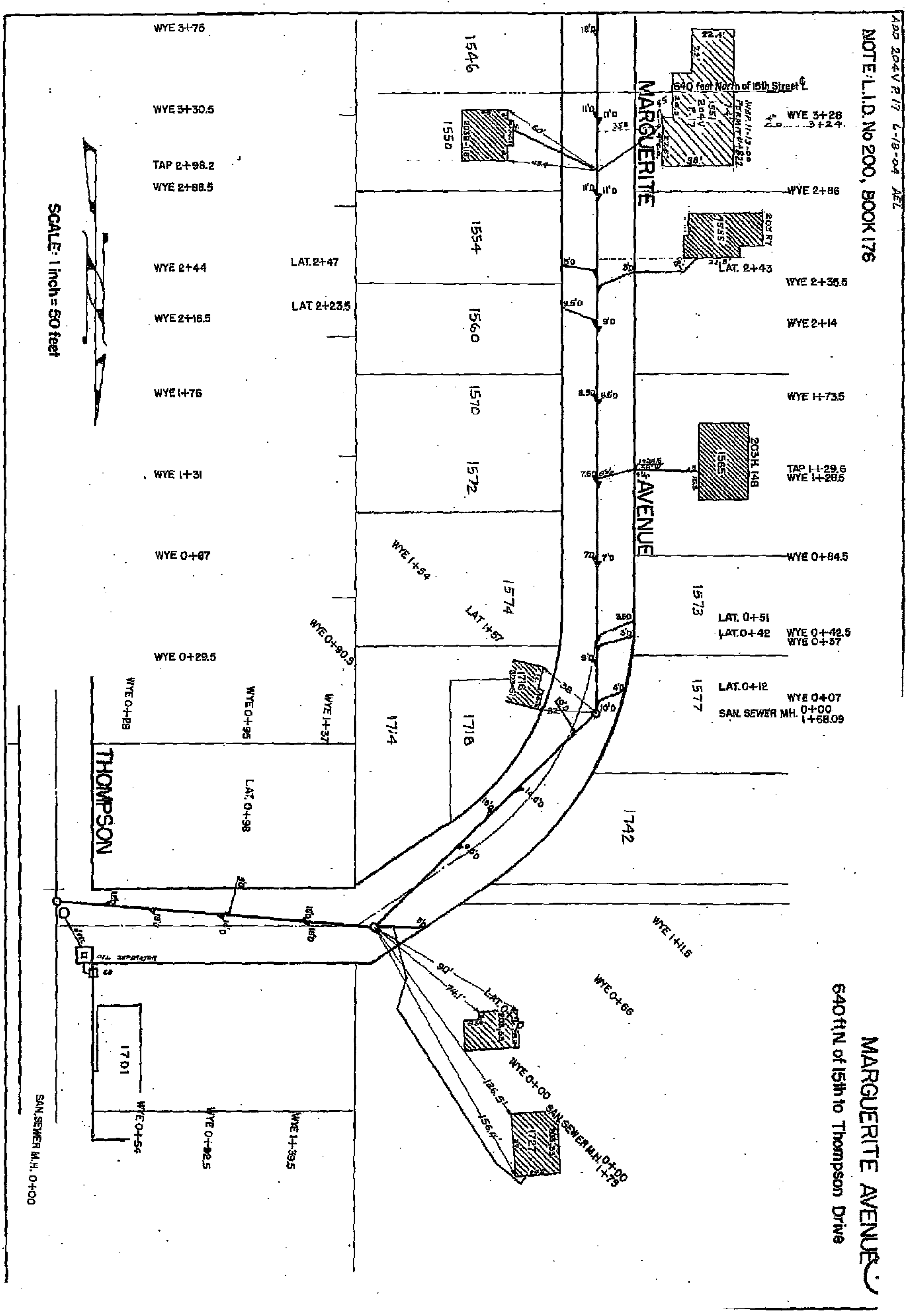
1" = 100'

DATE

FILE NO.

206
112 105

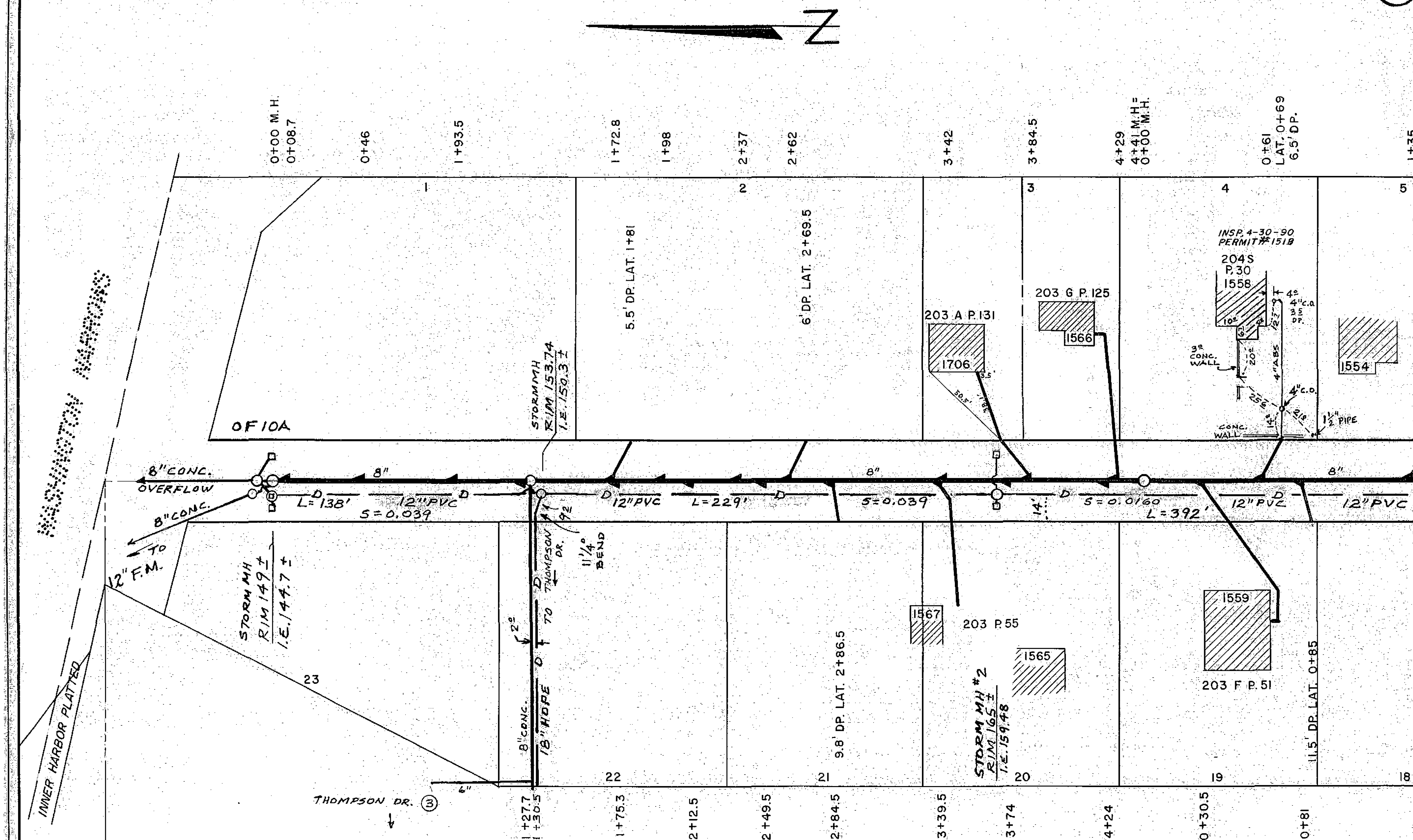

SEE THOMPSON DR. (1)
NOTE: LID 200, BOOK 176
SANITARY SEWER M.H. 0+00
F.L.=158.36
C.B. 4+87
RIM 166.53
I.E. 161.30 IN
I.E. 161.20 OUT
WYE 0+30.5 7' DP
WYE 0+78 7' DP
WYE 1+28 7' DP
WYE 1+68 8' DP
WYE 2+13 8.5' DP.
C.B. 2+87
RIM 161.96
I.E. 157.67 IN.
I.E. 157.57 OUT
WYE 2+89.8 8' DP
END LAT. 2+51.38 203F,78 (LATERAL TIE)
TAP 2+54.08 9' DP
WYE 3+19.5 6.5 DP
WYE 3+67 7' DP
C.B. 1+06
RIM 157.92
I.E. 154.37 IN
I.E. 154.27 OUT
WYE 4+17 9' DP
WYE 4+49 11' DP
MH 0+00
RIM 159.30
I.E. 152.15
SANITARY SEWER M.H. 4+82.76
F.L.=146.73
0+00
8" C.P. SAN. ABAND.
8" CONC.
GARDEN
TRACTS
SEE THOMPSON DR. (3)
WYE 1+08 6.5' DP
SCALE: 1 inch=50 feet
SANITARY SEWER L.H. 1+87
F.L.= 150.33
DS 55
18"
8"
C.P.
2.91%
SAN. SWR.
.02%
20
COHEN'S ADDITION
1555
1563
203H,130
1569
BAY
1577
204 T.P. 24
1718
MARGUERITE AVE.
8" C.P. SAN. SEWER
0+00
OIL SEPARATOR
CB
1701
204 N, P.83
VIEW
SEE THOMPSON DR. (3A)
WYE 0+28 7' DP
WYE 0+75.5 7' DP
WYE 1+26.5 7' DP
WYE 1+65.5 8' DP
WYE 2+10.5 8.5 DP
TAP 2+24 8.5 DP
WYE 2+57.2 8' DP
WYE 3+07.5 7' DP
WYE 3+64.5 7' DP
6" C.O.
0+88.5 3.5' DP
15.6'
LAT 4+01.5 6' DP
WYE 4+12 9' DP
WYE 4+46.5 10.7' DP
WYE 0+35.5 10.5 DP
WYE 0+76 8.5' DP
WYE 1+18.5 6' DP
WYE 1+48 5' DP
THOMPSON DRIVE
M.H. 600' NORTH OF 15th STREET
NORTH TO END.
2
DATE
REVISION REASON
INIT


NOTE: L.I.D. No 200, BOOK 176
MARGUERITE AVENUE
640 ft N. of 15th to Thompson Drive
SCALE: 1 inch = 50 feet
640 feet North of 15th Street
MARGUERITE
AVENUE
THOMPSON
WYE 3+76
WYE 3+30.5
TAP 2+98.2
WYE 2+88.5
WYE 2+44
LAT. 2+47
WYE 2+16.5
LAT. 2+23.5
WYE 1+76
WYE 1+31
WYE 0+87
WYE 0+29.5
WYE 3+28
WYE 2+86
LAT. 2+43
WYE 2+35.5
WYE 2+14
WYE 1+73.5
TAP 1+29.6
WYE 1+28.5
WYE 0+84.5
LAT. 0+51
LAT. 0+42
WYE 0+42.5
WYE 0+37
LAT. 0+12
WYE 0+07
SAN. SEWER MH. 0+00 1+68.09
WYE 1+54
LAT 1+57
WYE 0+90.5
WYE 0+29
WYE 0+95
WYE 1+37
LAT. 0+98
WYE 1+11.5
WYE 0+66
WYE 0+00
SAN. SEWER M.H. 0+00 1+73
WYE 0+54
WYE 0+92.5
WYE 1+39.5
SAN. SEWER M.H. 0+00
OIL SEPARATOR
1546
1550
1554
1560
1570
1572
1574
1714
1718
1716
1551
1555
1565
1573
1577
1742
1701
1724

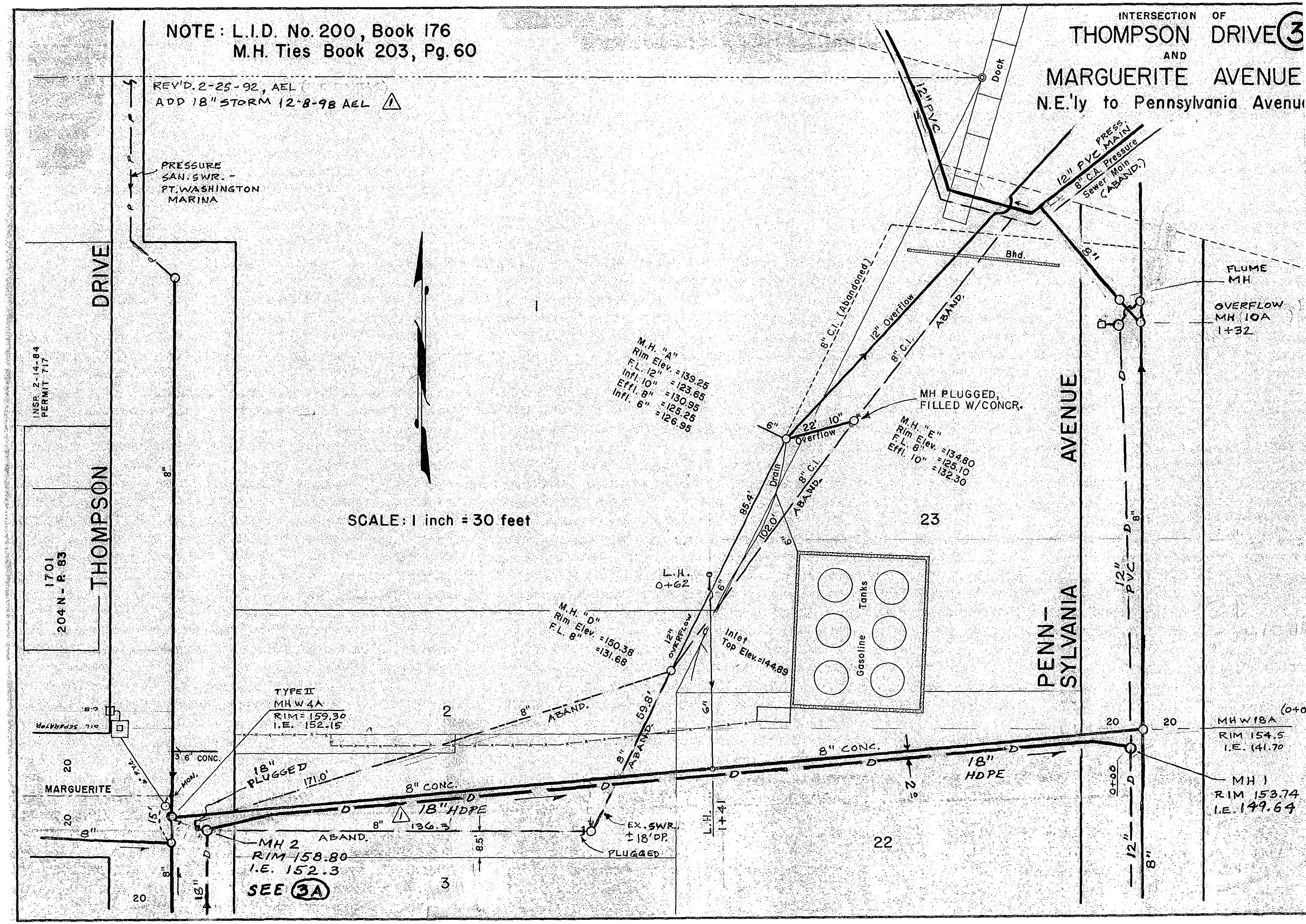
# PENNSYLVANIA AVE.

## WASHINGTON NARROWS SOUTH 5

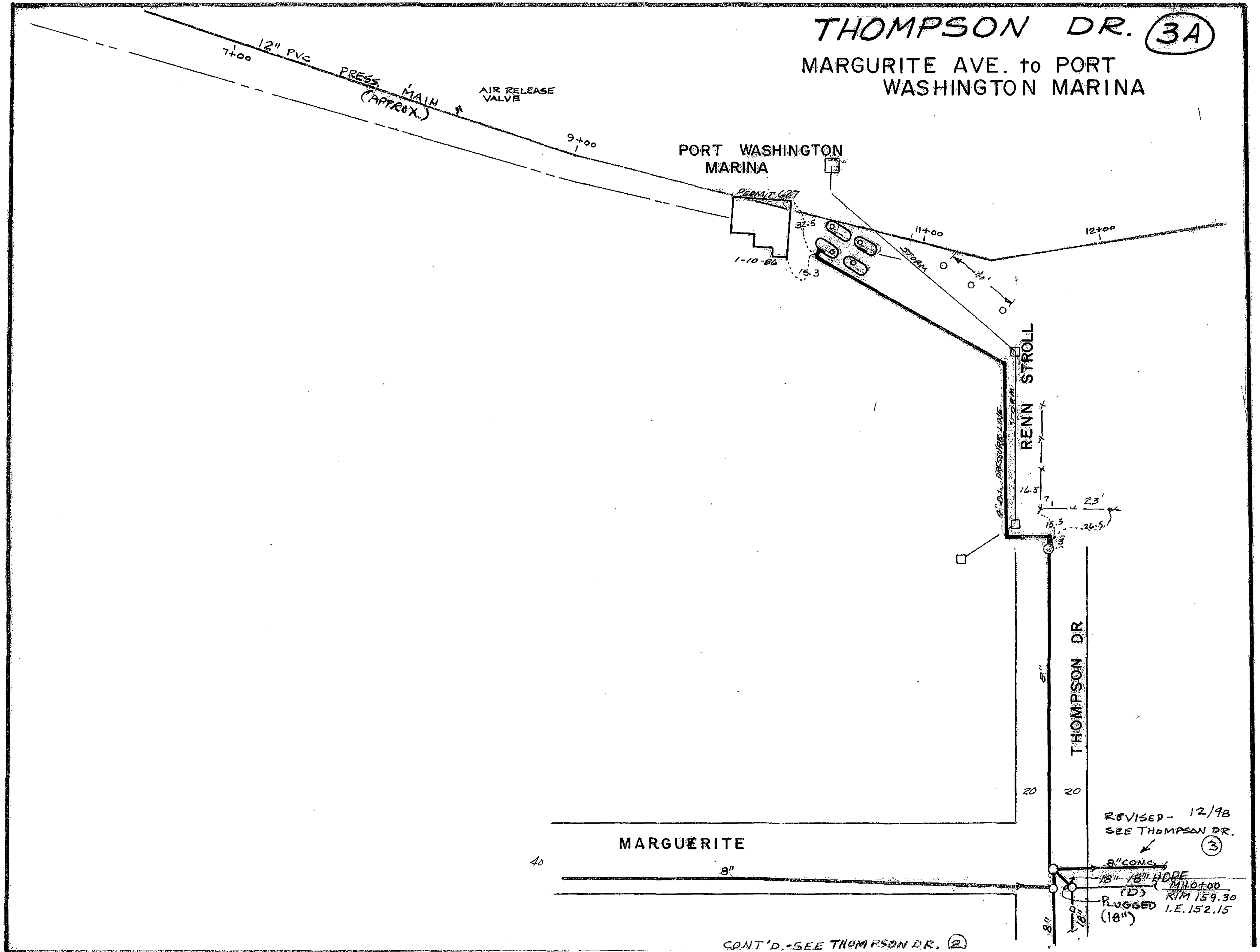
| REVISION BLOCK | | |
|---|---|---|
| DATE | REASON | INIT. |
| 5-2-90 | NEW CONST. | AEL |
| 12-8-98 | 12"STORM #1536 N'LY. | AEL |
| | | |
| | | |
| | | |




SCALE: 1"=50'



NOTE: L.I.D. No. 200, Book 176
M.H. Ties Book 203, Pg. 60
REV'D. 2-25-92, AEL
ADD 18" STORM 12-8-98 AEL
INTERSECTION OF
THOMPSON DRIVE
AND
MARGUERITE AVENUE
N.E.'ly to Pennsylvania Avenu
3
PRESSURE SAN. SWR. - PT. WASHINGTON MARINA
THOMPSON DRIVE
INSP. 2-14-84 PERMIT 717
1701 204 N - P. 83
SCALE: 1 inch = 30 feet
12" PVC
Dock
12" PVC PRESS. MAIN
8" C.A. Pressure Sewer Main (ABAND.)
Bhd.
8" C.I. (Abandoned)
12" Overflow
8" C.I. ABAND.
M.H. "A"
Rim Elev. = 139.25
F.L. 12" = 123.65
Infl. 10" = 130.95
Effl. 8" = 125.25
Infl. 6" = 126.95
MH PLUGGED, FILLED W/CONCR.
M.H. "E"
Rim Elev. = 134.80
F.L. 8" = 125.10
Effl. 10" = 132.30
22' 10" Overflow
85.4' Drain
102.0'
8" C.I. ABAND.
23
Tanks
Gasoline
L.H. 0+62
M.H. "D"
Rim Elev. = 150.38
F.L. 8" = 131.68
12" OVERFLOW
Inlet Top Elev. = 144.89
59.8'
8" ABAND.
8" ABAND.
2
TYPE II
MHW4A
RIM = 159.30
I.E. 152.15
18" PLUGGED
171.0'
3'6" CONC.
MON.
MARGUERITE
8" CONC.
18" HDPE
8" CONC.
18" HDPE
2%
8" ABAND.
136.3'
8.5'
EX. SWR. ± 18' DP.
PLUGGED
L.H. 1+41
MH 2
RIM 158.80
I.E. 152.3
SEE 3A
3
22
PENN-SYLVANIA AVENUE
FLUME MH
OVERFLOW MH 10A 1+32
12" PVC
MHW18A (0+00)
RIM 154.5
I.E. 141.70
MH 1
RIM 153.74
I.E. 149.64
0+00
20



THOMPSON DR. 3A
MARGURITE AVE. to PORT WASHINGTON MARINA
12" PVC PRESS. MAIN (APPROX.)
7+00
AIR RELEASE VALVE
9+00
PORT WASHINGTON MARINA
PERMIT 627
1-10-86
32.5
15.3
STORM
11+00
12+00
40'
RENN STROLL
4" D.I. PRESSURE LINE
STORM
16.5
23'
15.5
26.5
THOMPSON DR
8"
20
20
MARGUERITE
40
8"
REVISED - 12/98
SEE THOMPSON DR. 3
8" CONC.
18" 18" HDPE
(D)
MH 0+00
RIM 159.30
I.E. 152.15
PLUGGED (18")
8"
18"
CONT'D.-SEE THOMPSON DR. 2

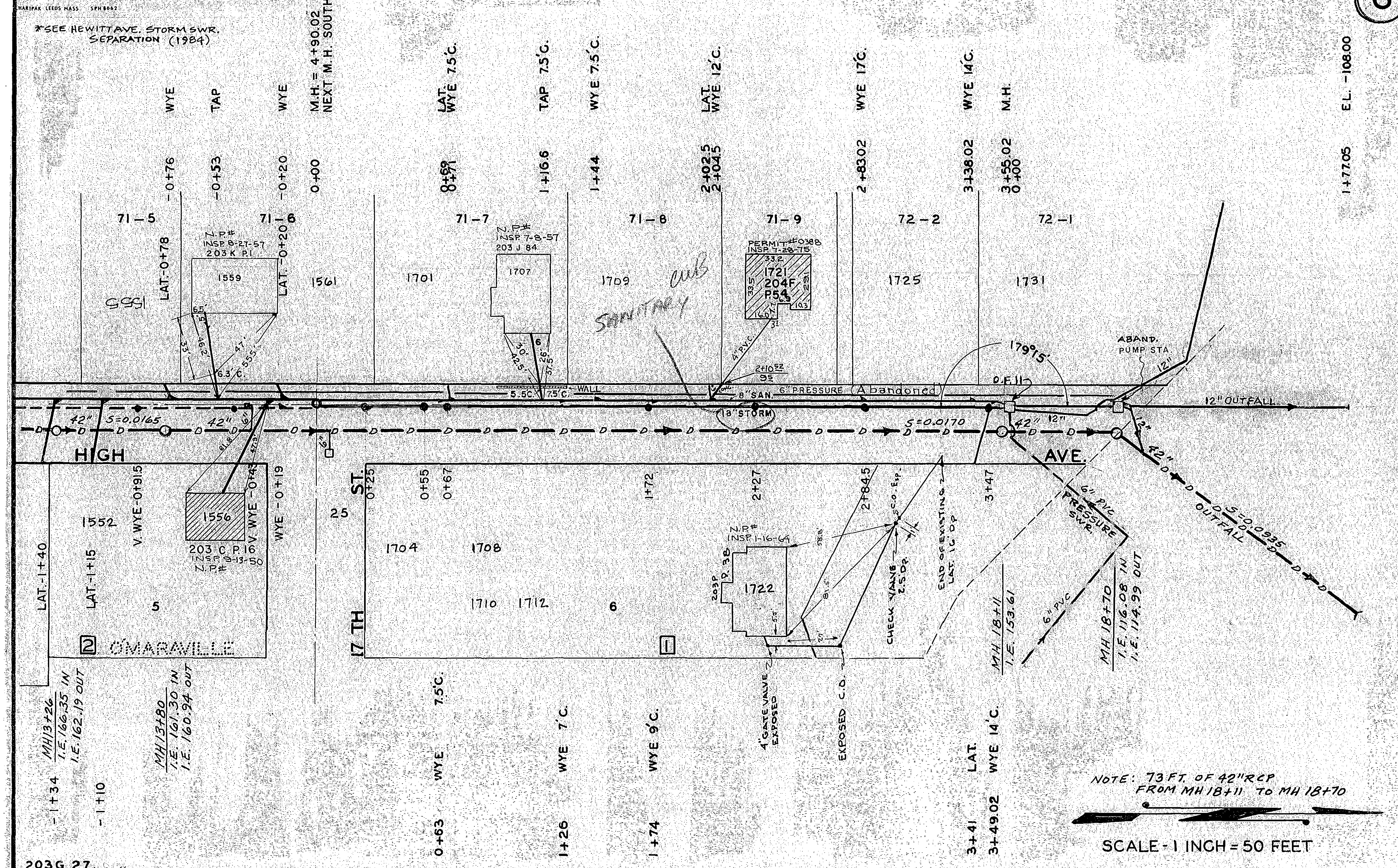
# HIGH AVE.
## 17 TH ST. TO N. END OF SEWER

6

| REVISION BLOCK | | |
|---|---|---|
| DATE | REASON | INIT. |
| 3-25-76 | PER FIELD INSP. | G.P.C. |
| 3-20-90 | STORM SWR. * | AEL |

CHARTPAK LEEDS MASS

*SEE HEWITT AVE. STORM SWR. SEPARATION (1984)




NOTE: 73 FT. OF 42" RCP FROM MH 18+11 TO MH 18+70

SCALE - 1 INCH = 50 FEET

203G 27

# APPENDIX D PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO

# APPENDIX D
# PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO
# REMOVAL EVALUATION WORK PLAN

## Bremerton Gas Works Site

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01

June 2013

Prepared by


Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

# APPENDIX D
# PRELIMINARY SCREENING EVALUATION FOR RECREATIONAL BEACH USER SCENARIO

## REMOVAL EVALUATION WORK PLAN

Prepared for: Cascade Natural Gas Corporation

Aspect Project No. 080239-003 •Anchor QEA Project No. 131014-01.01
June 2013

Aspect Consulting, LLC and Anchor QEA, LLC

# Contents



## List of Tables

# 1 Introduction

Cascade Natural Gas Corporation (Cascade) is conducting a Remedial Investigation and Feasibility Study (RI/FS) at the Bremerton Gas Works Site (Site) in Bremerton, Washington. The work is being conducted under the direction of the U.S. Environmental Protection Agency (EPA) under an Administrative Settlement Agreement and Order on Consent (AOC) as executed with EPA May 1, 2013.

Prior to execution of the AOC, a Time Critical Removal Action (TCRA) was completed to address sheen and odor observed on the adjacent Washington Narrows beach and associated with discharges from a combined sewer overflow (CSO) adjacent to and sharing historical drainage connections to the former gas works (Anchor QEA 2011).

Submittal of the Removal Evaluation Work Plan (Work Plan) to address potential imminent and substantial threats to human health, welfare, or the environment is the first task under the AOC. The Work Plan presents detailed descriptions of the data collection tasks to be performed to complete the removal evaluation. The Work Plan includes a detailed Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The AOC scope of work (SOW) requires a removal evaluation that includes the collection of 30 surface sediment samples and analysis of polycyclic aromatic hydrocarbons (PAHs) and total organic carbon (TOC) as information to help determine whether an additional removal action is warranted. These sediment data will be used to conduct a preliminary screening evaluation of potential Site-related risks using a recreational beach user scenario.

This appendix to the Work Plan describes the preliminary screening of potential human health risks to recreational beach users that will be used to support the removal evaluation. The screening-level risk evaluation will be performed as a supporting piece of information during the removal evaluation of intertidal beach sediments adjacent to the former gas works. This evaluation is intended for limited use during the removal evaluation to help assess the potential magnitude of human health risks associated with current beach conditions prior to implementation of the RI/FS. A baseline human health risk assessment (HHRA) and ecological risk assessment will be performed during the RI/FS, and that HHRA may supersede the screening level risk evaluation.

The preliminary screening of human health risks will focus on potential risks associated with dermal contact, incidental ingestion, and inhalation of carcinogenic polycyclic aromatic hydrocarbon (cPAH) compounds in beach sediments. These compounds can be elevated in residuals associated with manufactured gas plant operations. They can also be present in petroleum hydrocarbons, combustion byproducts, treated wood structures, and stormwater.

Section 2 of this appendix describes the methods and exposure assumptions used as the basis of the preliminary beach recreation scenario. Section 3 describes the data evaluation approach and qualitatively identifies associated uncertainties. Section 4 provides the references.

# 2 Methods and Assumptions

The preliminary recreational beach user scenario presented in this appendix is a risk-based evaluation derived from standardized equations combining site-specific and EPA default exposure information assumptions with current EPA toxicity data. In support of the EPA Superfund cleanup projects, EPA has developed the Regional Screening Levels (RSL) of Chemical Contaminants at Superfund Sites. While the published RSLs are generic, they may be recalculated using site-specific data. To aid in the development of site-specific screening levels at Superfund sites, EPA has provided a web-based RSL calculator. The "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website provides the calculator, a user's guide, links to EPA guidance, and answers to frequently asked questions regarding the use of RSLs[1]. All computations for the preliminary recreational beach user screening evaluation were done using the RSL calculator.

The following section describes the exposure parameters that are used in the RSL calculator and that can be applied as default values or adjusted using site-specific information. The EPA recreational soil/sediment exposure was used for the current analysis. All assumptions provided with EPA default values were used. Conservative site-specific exposure frequency (days/year) and event time (hours/event) were used as described below

## 2.1 Default RSL Calculator Parameters

The RSL calculator default age-dependent exposure parameters and values are summarized in Table D-1. The total exposure duration for the beach use scenario was 30 years, applied using early life stage adjustments to account for mutagenic effects of benzo(a)pyrene (EPA 2011). Body weight, skin surface area, skin adherence factors, and soil ingestion rates are based on RSL calculator default values for the residential soil scenario and were not modified. While the RSL inputs are updated periodically, the current RSLs are based on default exposure parameters and factors that represent reasonable maximum exposure (RME) conditions for long-term/chronic exposures and that are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991) and Soil Screening Guidance documents (1996 and 2002). In 2011, EPA updated the Exposure Factors Handbook (EFH; EPA 2011) but the newer parameters have not yet been incorporated into the RSLs. Updating the exposure parameters based on the newer EFH is beyond the scope of this screening evaluation. During the RI/FS, the HHRA will apply current EPA guidance, including the EFH, to develop a site-specific conceptual exposure model and determine appropriate exposure parameters.

[1] EPA 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm).

**Table D-1**
**RSL Calculator Default Age-dependent Exposure Parameters and Values**

| Age Class | Body Wt (kg) | Skin Surface Area ($cm^2$) | Skin Adherence Factor ($mg/cm^2$) | Soil Ingestion Rate (mg/day) | Exposure Duration (years) | Mutagenic Adjustment (unitless) |
|---|---|---|---|---|---|---|
| 0-2 | 15 | 2800 | 0.2 | 200 | 2 | 10 |
| 2-6 | 15 | 2800 | 0.2 | 200 | 4 | 3 |
| 6-16 | 70 | 5700 | 0.07 | 100 | 10 | 3 |
| 16-30 | 70 | 5700 | 0.07 | 100 | 14 | 1 |

## 2.2 Site-Specific Parameters

Beach play exposure frequency values have been evaluated recently by EPA at other marine sediment sites with similar accessibility and characteristics, including at the Lower Duwamish Waterway (LDW) Superfund Site. The beach play exposure analysis for the LDW Site was summarized in the final HHRA performed during the RI/FS study process (Windward 2007), and used an exposure frequency of 65 days/year. This is more conservative than the exposure frequency used by the Washington Department of Ecology (Ecology 2012) in its generic beach play scenario (41 days/year) for developing cleanup levels at State-lead cleanup sites.

The preliminary recreational beach user risk scenario to be used at the Site will use an exposure frequency of 65 days per year. This exposure frequency represents the 95th percentile for children from birth to 6 years of age who engage in playing and digging in the sand adjacent to the water and is based on a King County survey of established parks (Lake Union, Lake Washington, and Lake Sammamish) with sandy beaches (Parametrix 2003). These King County park areas are likely to have higher visitation rates than the beach adjacent to the Site.

The event time for the assumed recreational beach user scenario is 6 hours per event. This value is conservative for a tidally-inundated beach area. This value is applied to the estimate of inhalation exposure. For the purpose of developing the preliminary beach user screening evaluation, this value was assumed to be 6 hours per visit. Because cPAH compounds have very low volatility, the estimated exposure is very low and the contribution to risk is approximately four orders of magnitude lower than for soil ingestion or dermal contact. Regardless, the preliminary beach user scenario is based on all three exposure pathways: inhalation of soil vapor, soil ingestion, and dermal contact, consistent with the RSL calculation methods.

# 3 Data Evaluation and Uncertainty

The following sections describe the preliminary beach user screening evaluation and identify potential sources of uncertainty. A formal uncertainty evaluation will be completed as part of the baseline risk assessment that will be completed during the RI/FS process.

## 3.1 Preliminary Recreational Beach User Screening Evaluation

The preliminary recreational beach user scenario results in a protective total cPAH Toxic Equivalency Quotient (TEQ) concentration of 8 milligrams per kilogram (mg/kg) at the $10^{-4}$ risk level and 0.08 mg/kg at the $10^{-6}$ risk level (Table D-3). The use of this value in the screening of surface sediment samples collected under the Work Plan will be conducted in coordination with EPA.

## 3.2 Screening Evaluation Uncertainty

Uncertainties in the screening evaluation may include those associated with the default RSL calculator values as well as the assumed site-specific exposure frequency and event duration. Regarding the RSL calculator default values, EPA has issued new guidance updating the current scientific basis of exposure (Exposure Factors Handbook; EPA 2011). This new guidance has not yet been incorporated into the RSL calculator. Because this screening evaluation is being conducted in advance of the RI/FS and has a limited purpose in informing the removal evaluation, establishing site-specific exposure assumptions for parameters like body weight, skin surface area and skin adherence factors were determined to be beyond the scope of this work. The current EFH and other risk assessment requirements and guidance will be addressed fully in the risk assessment work plan, which will be prepared in coordination with EPA as part of the RI/FS process

The preliminary recreational beach user scenario assumed an exposure frequency of 65 days based on a regional survey of park beaches, as described above in Section 2.2. For reference, Ecology (2012) has also developed a beach play scenario for use in evaluating human health risk under the Washington Sediment Management Standards (SMS). The exposure frequency for the SMS beach play scenario is 41 days, based on the assumption that beach visits occur 3 days per week during school vacation, and 1 day per week for 5 weeks from mid-September to the end of October.

As described in Section 2.2, the assumption of 65 daily visits per year is likely to be conservative because the beach adjacent to the Site lack the amenities found at the King County parks (i.e., rest rooms, picnic tables, lawn, parking area). As such, the Ecology (2012) value of 41 daily visits per year may be a more reasonable estimate for an area like the Washington Narrows beach adjacent to the Site. A complete evaluation of relevant recreational beach user exposure frequencies and associated uncertainty will be completed during the risk assessment.

## 3.3 Exposure Data Uncertainty

Uncertainty around the exposure to total cPAHs TEQ in beach sediments can take two forms, in the calculation of the total cPAH TEQ and in the estimation of exposure to recreational beach users. These two forms of uncertainty will be evaluated in the risk assessment conducted during the RI/FS process and are outside of the scope of the Work Plan.

### *3.3.1 Total cPAH TEQ Calculation*

The differences in the way the sample total cPAH TEQ is calculated may over or underestimate the true potency of the benzo(a)pyrene equivalent concentration. The total cPAH concentration is computed with individual cPAH weighted according to their benzo(a)pyrene toxicity equivalency factor (TEF). The total cPAH TEQ is the weighted sum of the individual compounds (Table D-2). As additional toxicity data have been developed by researchers, TEFs have been updated in the scientific literature (e.g., EPA 1993, Collins et al. 1998, CalEPA 2002). Promulgated TEFs under the Washington Model Toxics Control Act (MTCA) may be changed depending on programmatic updates (e, g., MTCA 2001 and MTCA 2007).

**Table D-2**
**Summary of cPAH Toxicity Equivalency Factors**

| Compound | EPA (1993)/EPA RSL Calculator | CalEPA (2002)/ MTCA 2007 |
|---|---|---|
| Benzo(a)pyrene | 1 | 1 |
| Benz(a)anthracene | 0.1 | 0.1 |
| Benzo(b)fluoranthene | 0.1 | 0.1 |
| Benzo(k)fluoranthene | 0.01 | 0.1 |
| Chrysene | 0.001 | 0.01 |
| Dibenz(a,h)anthracene | 1 | 0.1 |
| Indeno(1,2,3-c,d)pyrene | 0.1 | 0.1 |

For the removal evaluation, the TEFs from EPA (1993) *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* will be applied to calculate sample total cPAH TEQ concentrations. The EPA RSL webpage users guide (November 2012) references the EPA (1993) TEFs for comparison to RSLs. As an additional point of comparison, the TEFs promulgated under the current MTCA rule (2007) will be applied to calculate cPAH TEQ values used in exposure estimates. The MTCA cPAH TEQ values will be calculated because they represent a more current evaluation of cPAH potency and because MTCA is an applicable or relevant and appropriate requirement (ARAR) under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). To better understand the uncertainty associated with censored data, sample total cPAH TEQ concentrations will be calculated in two ways, with undetected compounds set equal to zero or equal to one-half.

### *3.3.2 Recreational Beach User Exposure Concentrations*

For the Removal Evaluation Report, surface sediment analytical data will be summarized in tables and presented on figures depicting station sample concentrations of total cPAH TEQ results. The evaluation of the risk screening results will be performed in coordination with EPA.

# 4 References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# TABLE D-3
# WEBSITE OUTPUT FILE: EPA REGIONAL SCREENING LEVEL RISK CALCULATOR INPUTS AND RESULTS FOR RECREATIONAL BEACH USER SCENARIO

# Site-specific



## Recreator Equation Inputs for Soil

| Variable | Value |
|---|---|
| TR (target cancer risk) unitless | 1.0E-6 |
| $SA_{recsc}$ (skin surface area - child) $cm^2$/day | 2800 |
| $SA_{recsa}$ (skin surface area - adult) $cm^2$/day | 5700 |
| $SA_{0-2}$ (skin surface area - mutagenic) $cm^2$/day | 2800 |
| $SA_{2-6}$ (skin surface area - mutagenic) $cm^2$/day | 2800 |
| $SA_{6-16}$ (skin surface area - mutagenic) $cm^2$/day | 5700 |
| $SA_{16-30}$ (skin surface area - mutagenic) $cm^2$/day | 5700 |
| $SA_{recsa}$ (skin surface area - adult) $cm^2$/day | 5700 |
| THQ (target hazard quotient) unitless | 1 |
| LT (lifetime - recreator) year | 70 |
| $IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg | 7428.571 |
| $DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg | 23452 |
| $IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg | 31819.048 |
| $DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg | 93955.333 |
| $EF_{0-2}$ (exposure frequency) day/year | 65 |
| $EF_{2-6}$ (exposure frequency) day/year | 65 |
| $EF_{6-16}$ (exposure frequency) day/year | 65 |
| $EF_{16-30}$ (exposure frequency) day/year | 65 |
| $EF_{recsc}$ (exposure frequency - child) day/year | 65 |
| $EF_{recsa}$ (exposure frequency - adult) day/year | 65 |
| $EF_{recsa}$ (exposure frequency - adult) day/year | 65 |
| $EF_{recs}$ (exposure frequency - recreator) day/year | 65 |
| $IRS_{0-2}$ (soil intake rate) mg/day | 200 |
| $IRS_{2-6}$ (soil intake rate) mg/day | 200 |
| $IRS_{6-16}$ (soil intake rate) mg/day | 100 |
| $IRS_{16-30}$ (soil intake rate) mg/day | 100 |
| $IRS_{recsc}$ (soil intake rate - child) mg/day | 200 |

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# Site-specific
## Recreator Equation Inputs for Soil

| Variable | Value |
|---|---|
| $IRS_{recsa}$ (soil intake rate - adult) mg/day | 100 |
| $IRS_{recsa}$ (soil intake rate - adult) mg/day | 100 |
| $ED_{0-2}$ (exposure duration) year | 2 |
| $ED_{2-6}$ (exposure duration) year | 4 |
| $ED_{6-16}$ (exposure duration) year | 10 |
| $ED_{16-30}$ (exposure duration) year | 14 |
| $ED_{recsc}$ (exposure duration - child) year | 6 |
| $ED_{recsa}$ (exposure duration - adult) year | 24 |
| $ED_{recsa}$ (exposure duration - adult) year | 24 |
| $ED_{recs}$ (exposure duration - recreator) year | 30 |
| $ET_{0-2}$ (exposure time) hr/day | 6 |
| $ET_{2-6}$ (exposure time) hr/day | 6 |
| $ET_{6-16}$ (exposure time) hr/day | 6 |
| $ET_{16-30}$ (exposure time) hr/day | 6 |
| $ET_{recsc}$ (exposure time - child) hr/day | 6 |
| $ET_{recsa}$ (exposure time - adult) hr/day | 6 |
| $ET_{recsa}$ (exposure time - adult) hr/day | 6 |
| $ET_{recs}$ (exposure time - recreator) hr/day | 6 |
| $BW_{0-2}$ (body weight) kg | 15 |
| $BW_{2-6}$ (body weight) kg | 15 |
| $BW_{6-16}$ (body weight) kg | 70 |
| $BW_{16-30}$ (body weight) kg | 70 |
| $BW_{recsc}$ (body weight - child) kg | 15 |
| $BW_{recsa}$ (body weight - adult) kg | 70 |
| $BW_{recsa}$ (body weight - adult) kg | 70 |
| $AF_{0-2}$ (skin adherence factor) $mg/cm^2$ | 0.2 |
| $AF_{2-6}$ (skin adherence factor) $mg/cm^2$ | 0.2 |
| $AF_{6-16}$ (skin adherence factor) $mg/cm^2$ | 0.07 |
| $AF_{16-30}$ (skin adherence factor) $mg/cm^2$ | 0.07 |

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# Site-specific

## Recreator Equation Inputs for Soil

| Variable | Value |
|---|---|
| $AF_{recsc}$ (skin adherence factor - child) $mg/cm^2$ | 0.2 |
| $AF_{recsa}$ (skin adherence factor - adult) $mg/cm^2$ | 0.07 |
| $AF_{recsa}$ (skin adherence factor - adult) $mg/cm^2$ | 0.07 |
| City (Climate Zone) PEF Selection | Default |
| $A_c$ (acres) PEF Selection | 0.5 |
| $Q/C_{wp}$ ($g/m^2$-s per $kg/m^3$) PEF Selection | 93.77 |
| PEF (particulate emission factor) $m^3/kg$ | 1359344438 |
| A (PEF Dispersion Constant) | 16.2302 |
| B (PEF Dispersion Constant) | 18.7762 |
| C (PEF Dispersion Constant) | 216.108 |
| V (fraction of vegetative cover) unitless | 0.5 |
| $U_m$ (mean annual wind speed) m/s | 4.69 |
| $U_t$ (equivalent threshold value) | 11.32 |
| F(x) (function dependant on $U_m/U_t$) unitless | 0.194 |
| City (Climate Zone) VF Selection | Default |
| $A_c$ (acres) VF Selection | 0.5 |
| $Q/C_{wp}$ ($g/m^2$-s per $kg/m^3$) VF Selection | 68.18 |
| foc (fraction organic carbon in soil) g/g | 0.006 |
| ρ$_b$ (dry soil bulk density) $g/cm^3$ | 1.5 |
| ρ$_s$ (soil particle density) $g/cm^3$ | 2.65 |
| θ$_w$ (water-filled soil porosity) $L_{water}/L_{soil}$ | 0.15 |
| T (exposure interval) s | 9.5e8 |
| A (VF Dispersion Constant) | 11.911 |
| B (VF Dispersion Constant) | 18.4385 |
| C (VF Dispersion Constant) | 209.7845 |

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# Site-specific

**Recreator Screening Levels (RSL) for Soil**

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

| Chemical | CAS Number | Mutagen? | VOC? | Ingestion SF $(mg/kg\text{-}day)^{-1}$ | SFO Ref | Inhalation Unit Risk $(ug/m^3)^{-1}$ | IUR Ref | Chronic RfD (mg/kg-day) | RfD Ref | Chronic RfC $(mg/m^3)$ | RfC Ref | GIABS | ABS | RBA | Volatilization Factor $(m^3/kg)$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo[a]pyrene | 50-32-8 | Yes | No | 7.30E+00 | I | 1.10E-03 | C | - | | - | | 1 | 0.13 | 1 | - |

| Chemical | Soil Saturation Concentration (mg/kg) | Particulate Emission Factor $(m^3/kg)$ | Ingestion SL TR=1.0E-6 (mg/kg) | Dermal SL TR=1.0E-6 (mg/kg) | Inhalation SL TR=1.0E-6 (mg/kg) | Carcinogenic SL TR=1.0E-6 (mg/kg) | Ingestion SL (Child) HQ=1 (mg/kg) | Dermal SL (Child) HQ=1 (mg/kg) | Inhalation SL (Child) HQ=1 (mg/kg) | Noncarcinogenic SL (Child) HI=1 (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo[a]pyrene | - | 1.36E+09 | 1.10E-01 | 2.87E-01 | 2.56E+04 | 7.95E-02 | - | - | - | - |

| Chemical | Ingestion SL (Adult) HQ=1 (mg/kg) | Dermal SL (Adult) HQ=1 (mg/kg) | Inhalation SL (Adult) HQ=1 (mg/kg) | Noncarcinogenic SL (Adult) HI=1 (mg/kg) | Screening Level (mg/kg) |
|---|---|---|---|---|---|
| Benzo[a]pyrene | - | - | - | - | 7.95E-02 ca |

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